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REPORT

OF THE

TESTS OF METALS

AND

OTHER MATERIALS

FOR

INDUSTRIAL PURPOSES

MADE WITH THE

UNITED STATES TESTING MACHINE AT WATERTOWN ARSENAL, MASSACHUSETTS,

DURING

THE FISCAL YEAR ENDED JUNE 30, 1894.

WASHINGTON:
GOVERNMENT PRINTING OFFICE,
1895.

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LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

The report of the commanding officer at Watertown Arsenal, Massachusetts, of the tests of metals and other materials for industrial purposes made during the fiscal year ended June 30, 1894.

WAR DEPARTMENT,
Washington, D. C., December 3, 1894.

SIR: I have the honor to transmit herewith the report of the commanding officer at Watertown Arsenal, Massachusetts, dated October 6, 1894, of the tests of materials made at that arsenal during the fiscal year ended June 30, 1894, which report was submitted to this Department by the Chief of Ordnance of the Army and is transmitted to Congress in accordance with the requirements of existing law.

Very respectfully,

DANIEL S. LAMONT,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

WATERTOWN ARSENAL,
Watertown, Mass., October 6, 1894.

SIR: I have the honor to submit herewith the following report of tests of materials made at this arsenal during the fiscal year ending June 30, 1894, in compliance with the requirements of law.

The total number of specimens tested during the year was 2,159, classified as follows:

Gun specimens	312
For Ordnance Department	145
For other Government departments	142
Investigative tests	954
Tests for private parties	606
Total	2,159

The receipts and expenditures were as follows:

Amount appropriated for testing machine and testing work	$10,000.00
Received during the year from private parties	1,396.11
Total received	11,396.11
Amount expended for service and labor	9,197.67
Amount expended for light, power and tools, implements, and materials for tests	2,198.44
Total expended	11,396.11

Public tests during the year have included material representing the steel forgings for 8, 10, and 12 inch B. L. rifles, cast iron for the bodies of 12-inch B. L. rifled mortars, steel for small arms, steel and iron castings for carriage work, and cast-iron projectile metal, together with brass and bronze castings and other miscellaneous tests.

This material represents work in current fabrication in the Department.

Chain cable, shackles, and swivels were tested for the United States light-house inspectors, and shot lines for the United States Life-Saving Service.

Proof stresses were applied to tackle blocks of unusual capacity for the Bureau of Yards and Docks, United States Navy.

These tests, for the most part, have been made to ascertain whether the material possessed the physical properties requisite for acceptance and use, although the tests of the cast irons from the Watertown Arsenal Foundry have assumed more of an investigative character, from the fact that the mechanical tests are accompanied by a statement of furnace charges and with full chemical analyses of the test pieces representing the castings.

Tests for private parties have been made according to law, which places the testing machine at the disposal of any citizen of the United States upon payment of the cost of making the tests. A list of the parties who have had tests made during the past fiscal year is appended to this report.

The results of tests made for private parties are not published. They belong to those who defray the cost of testing.

The investigative tests of the present report represent many features of unusual interest.

HYDROSTATIC TEST OF 8-INCH TUBE SECTION.

The series of tests by hydrostatic pressure of an 8-inch tube section, upon which some results were presented in the last annual report, have, so far as the main series is concerned, been completed, and are included herein.

The investigation has comprised tests with interior and exterior pressures taken singly and together; also the same pressures combined with longitudinal stresses of tension and of compression.

Diametrical and longitudinal strains were measured when the radial pressures were applied singly or in combination with a longitudinal stress.

When interior and exterior pressures were applied at the same time longitudinal strains only were measured, the cylindrical surfaces necessarily being inaccessible.

The combinations of pressures met many of the conditions present in a gun, and this experimental demonstration of the action of the metal under such analogous conditions gives great importance to the results.

It is not the least gratifying feature of these tests to observe the close harmony existing between these experimental and the predicted results which were based on the formulæ for gun construction adopted by the Ordnance Department, United States Army.

The ratio of longitudinal to diametrical strains, announced in the report of 1893 to be $\frac{1}{3.64}$ when interior pressures were employed and from observations on a rectangular bar under direct tensile stress, is closely confirmed in the present tests by exterior pressure, where the ratio found is $\frac{1}{3.72}$.

Advantage will be taken of the facilities afforded by the apparatus which was made in carrying out the main series of tests to add further data to the subject by supplementary tests on pressures exceeding the elastic limit of the metal, and by means of drilled pockets carrying pins reaching different depths from the surface of the tube ascertain the diametrical strains at different parts of the thickness of the tube.

Some further work remains to be done with the tube subjected to combined radial and longitudinal stresses, as the results in some instances show a variance between the observed data and the algebraic sum of the strains developed by the component stresses when not in combination.

RAILROAD-TRACK EXPERIMENTS.

A series of twelve diagrams illustrate the results of some experiments on the behavior of rails under actual conditions of service.

Two weights of rails were experimented with, a 66-pound and a 75-pound section. They rested on oak ties in each case, but two kinds of ballast were used—gravel and cinder.

The depressions of the rails were observed under locomotives of different types and different weights.

Observations were also made on the depression of the roadbed in the vicinity of the locomotive, as it was found that not only were the rails depressed under the weight of the locomotive, but there was a sensible depression of the roadbed under and for some distance on each side of so great a weight.

The character of the ballast exerts a decided influence on the total depression of the rails.

Profiles show how differently the rails are depressed under engines of different wheel bases, and the modifications in curves due to the weights on the leading truck wheel and tender wheels over the class of switching engines in which the entire weight is carried on the driving wheels.

The fiber stresses were ascertained by measuring the strains developed in the bases of the rails, and stresses reaching 13,810 pounds per square inch were found with the track in normal condition, while removing the tie increased the fiber stress at that point to 16,430 pounds per square inch.

Advance wave determinations were made showing the elevation of the rail before the locomotive.

Much interest centers on these practical tests, which are carried on for the purpose of ascertaining the behavior of material in service in situations where synthetical deductions are difficult and uncertain from the number of unknown functions present.

So little is known of the action of the roadbed and ties that a determination of the fiber stresses in rails necessarily becomes the subject of experimental inquiry.

These results should assist in the drawing up of suitable specifications for the material of rails.

The large number of laboratory experiments become of greater value and their application more satisfactory when supplemented by these direct inquiries. In fact, it is believed that tests having for their object practical determinations of strains in existing structures would generally supply important data, and it is intended to give considerable prominence to these lines of investigation.

BUILDING MATERIAL.

During the past fiscal year samples of building material have been collected from many different States. The tests of some of this material are reported herein, and other tests will be made during the current year.

It is intended in this series to include representative material from all parts of the country, that the constructive value of the building material resources shall be fully illustrated.

The tests with stones, brick, and clay products in general will not only include the ordinary compression tests of the material, but will be greatly extended so as to determine many physical properties rarely developed by experimental investigation—properties believed to play important parts in the durability of the material and its general behavior under different circumstances.

In the present report will be found many observations on the elastic properties of stones from whence may be seen how unlike stones are in respect to their degree of compressibility.

Stones of extreme softness stand to those of extreme rigidity in about the ratio of 1 to 7.

The differences in structure are further shown by observations on the ratio of lateral expansion to longitudinal compression of the material. The values found range between $\frac{1}{2.9}$ and $\frac{1}{11}$.

The coefficients of expansion were determined with the stones in water baths covering a range of temperature from about freezing to boiling water.

The swelling of some stones immersed in water was noted, and a similar effect on other stones due to exposure to higher temperatures was also observed.

Sandstones generally swell most upon exposure to moisture, and the marbles acquire the greatest permanent sets due to elevation of temperature.

It can not yet be said that marbles as a class of stones develop larger permanent sets than dolomites, yet so far as our present experiments extend such is the case, the maximum temperatures not greatly exceeding 400° F. in the experiments referred to.

Strangely enough, while exposure to higher temperatures increases the permanent sets of many stones, a sandstone from the State of Oregon was experimented with in which the permanent swelling of the water baths was very sensibly decreased upon heating to a temperature of 410° F. in a dry atmosphere.

The remarkable loss of strength of some sandstones when wet, but from which they again recover when dry, has been observed. An extreme instance of this kind showed the wet stone to sustain only about one-fifth the dry crushing strength.

Questions pertaining to the fire-resisting properties of stones will be investigated.

The effects of rapid and slow heating, with observations on the changes in dimensions, both temporary and permanent, and whether there is impairment of elastic properties and compressive strength when subsequently cooled, is one line of inquiry suggested. This method of investigating the effects of heat seems to promise tangible results.

Chemical analyses have been made of samples of the pulverized material giving the average composition of the rock. These results will be supplemented by treatment of samples of the rock in their orig-

inal condition as quarried to the action of solvents, which may aid in explaining the phenomena of the mechanical tests.

The lines of investigation for this class of material have by no means been exhausted, and it is believed a comparison of building stones of well-established durability under conditions of weather and loads with stones known on the other hand to be deficient in this respect will enable us to identify what characteristics are favorable or what unfavorable in building material.

At the close of the World's Columbian Exposition samples of building material which had been on exhibit by the different States were forwarded to this arsenal and were tested, and these results are included in this report.

MUSIC WIRE.

Some music-wire samples were also obtained for testing from exhibited material at the Exposition.

Complete tests of elastic properties and tensile strength were made, with coiling, swaging, and eyeing tests.

It appears from the reports of earlier tests on this kind of wire that a great advance in tensile strength has been made in wires of recent manufacture.

The maximum strength found, one of the smallest sized wires, No. 12 music-wire gauge, was 462,870 pounds per square inch. The actual diameter of this wire was 0.0284 inch.

The elongations and permanent sets were measured on wires of each size from No. 12 to 27 music-wire gauge by a micrometer attached to the specimen by forked clips, which enabled the measurements to be taken without injury to the wire at the points of contact with the instrument.

Tests of specimens prepared with eyed ends, as generally used in pianofortes, were made.

The behavior of these specimens was very erratic and the loss in strength considerable. This was the case both with samples which had been eyed by the manufacturers of the wire, and those specimens which were eyed by a prominent firm of piano string makers.

The manner of fracture, an oblique shearing surface, indicated injury had been done the wire by the torsional set given the parts twisted together to form the eye.

Some eyes were formed at this arsenal which were made by twisting the parts of the wire together without the torsional set, as described in remarks accompanying the details of the tests.

Better results were obtained with these improved eyes, both as regards the strength they developed and the uniformity of the results, the strength developed being about the same as wires tested over $\frac{5}{16}$-inch pins, corresponding to the wrest pins in musical instruments.

ENDURANCE TESTS OF METALS.

These tests, in the form of rotating shafts, have been continued from former years. The information thus derived on the number of repetitions of alternate stresses necessary to produce rupture in metals of different tensile properties is of much interest.

The fiber stresses experimented with are relatively much greater than would be applied in service to metals in so-called permanent structures.

The speed of rotation has been increased from 400 to 1,500 per minute, and the shafts have been maintained at nearly uniform temperatures by means of a stream of water played upon them.

Considerable time is required to develop results of this class, notwithstanding the application of high fiber stresses and rapid alternations of loads.

Tensile tests of the several grades of steel employed show comparatively uniform results, but the tests with repeated stresses are characterized by variations of great magnitude. Inasmuch as the two tests do not follow parallel courses it strongly suggests that other properties besides those developed by the tensile tests contribute toward the endurance of repeated stresses.

Judging from the tests which have been made up to the present time, the stresses which can be repeatedly applied, for what might be considered practically an indefinite period, are much below the tensile elastic limits of the medium hard steels. In fact, the tendency is toward a limit below 35,000 pounds per square inch for the grades represented in this report, notwithstanding elastic limits of the higher carbon steels reach 83,000 pounds per square inch.

That a steel of high elastic limit will endure the application of higher loads for a given number of times than a mild steel, tests in this series clearly show, but considering the behavior of the two grades of metals under repeated loads extending over a practically indefinite period, the tests raise the question of how much permanent gain has been acquired by the higher grades of steel.

The indications now are that steels of high tensile properties do not possess correspondingly high limits of endurance to repeated stresses of long duration.

This is about as far as a general statement of the case can be made.

To aid in showing what phases the metal of these shafts passes through from the original state of the steel until rupture occurs tensile tests have been made of specimens taken from ruptured endurance shafts.

The specimens have been made annular in form, boring out the metal at the central part of the shaft and testing only the metal near the surface, where the fiber stresses during the rotating tests were the highest.

Tensile tests of these specimens suggest some explanation for the anomalous fact that repeated alternate stresses eventually rupture metals, notwithstanding fiber stresses not equaling the tensile elastic limits are used.

To obtain as direct a comparison of results as possible the same form of annular specimens were taken from the outer ends of the rotating shafts and the strength of the middle and end specimens compared.

Accompanying the details of these tests in the body of the report is a table showing the loss or gain in the middle specimens over the end ones, from whence it may be seen that a number of the middle specimens developed a much higher tensile strength than the shaft originally possessed, as shown by the corresponding end specimen.

In some tests the middle specimen showed a loss, while in other cases the differences were not very pronounced between the two specimens from the same shaft.

The greatest gain displayed by the middle specimen was 21,320 pounds per square inch, two other specimens showing 14,350 and 13,950 pounds per square inch, respectively.

Three of the middle specimens showed a loss, the least 7,000, the greatest 14,030 pounds per square inch.

Specimens which showed a loss and many which showed a gain in tensile strength developed upon testing minute surface cracks.

Exhaustion of ductility or toughness seems to follow the application of repeated alternate stresses when the stresses are of sufficient mag-

nitude to eventually rupture the metal, and during the time this annihilation of toughness is going on there is apparently a gain in tensile strength.

When the exhaustion of the toughness is complete and the loads on the shafts are sufficiently great incipient rupture begins, circumferential cracks are developed, and by reason of their general development and extension final rupture of the shaft soon follows.

The higher tensile strength and less toughness displayed by some of the middle specimens than was possessed originally by the shaft furnishes grounds for the belief that individual parts of the steel are actually loaded to this maximum tensile strength before rupture of the shaft takes place, notwithstanding the low computed fiber stress on the shaft.

If this deduction is true, then tensile strength is at least a function of the durability of metal working under high fiber stresses, the metal passing through a state of maximum cohesive resistance, although finally rupturing under a load apparently below its primitive elastic limit.

Final rupture occurring under a load below the primitive elastic limit makes it appear that gradual relaxation or loss in strength followed the stage of maximum strength, but the evidence on this point is by no means conclusive. Efforts are being made to develop such additional facts as may throw light upon this important subject.

MISCELLANEOUS TESTS.

Each annual report contains a number of tests on special subjects intended to develop special features in connection with current work in the Ordnance Department or other departments of the Government.

These tests frequently supplement the more elaborate series of investigations in addition to the immediate objects of the tests, and much general information, available in many ways, is found among these detached tests.

The operations of the machine have been conducted and the tests and reports made, as usual, by Mr. James E. Howard, C. E., to whose great experience and extreme carefulness we are indebted for the scope and accuracy of the tests.

The analyses and photographs have been made by Mr. Edwin K. MacNutt, the capable chemist in charge of the laboratory connected with the testing department. They form a very necessary part of the report.

Very respectfully, your obedient servant,

J. W. REILLY,
Major, Ordnance Department, U. S. A., Commanding.

The CHIEF OF ORDNANCE, U. S. A.,
Washington, D. C.

REPORT

OF THE

TESTS OF METALS AND OTHER MATERIALS

FOR

INDUSTRIAL PURPOSES,

MADE WITH THE

UNITED STATES TESTING MACHINE AT WATERTOWN ARSENAL, MASSACHUSETTS,

DURING

THE FISCAL YEAR ENDED JUNE 30, 1894.

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8-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES AND JACKETS.

TUBE NO. 25.

No. 4998.

Marks, 8 R T / B T 10
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000167	.000167	....	....	
2,500	10,000	.000367	.000200	....	....	
5,000	20,000	.000700	.000333	....	....	
7,500	30,000	.001033	.000333	....	....	
8,750	35,000	.001300	.000267	.000033	.000033	
9,000	36,000	.001333	.000033	....	....	
9,250	37,000	.001333	0.	....	....	
9,500	38,000	.001367	.000034	....	....	
9,750	39,000	.001400	.000033	....	....	
10,000	40,000	.001433	.000033	....	....	
21,900	87,600	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section....pounds.. 87,600
Elongation per inch after rupture....inch.. .1800
Reduction in diameter at point of rupture....do... .104
Reduction in area after rupture, per cent of original section.... 33.5
Position of rupture.... 1″ from neck
Character of broken surface.... silky, serrated
Elongation of inch sections.... ″.11, ″.16, ″.27*

TUBE NO. 25.

No. 4999.

Marks, $\frac{8\ R_{28}\ T}{M\ T_{16}}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000700	.000367	.....	.....	
7,500	30,000	.001067	.000367	.....	.....	
8,750	35,000	.001333	.000266	0.	.....	
10,000	40,000	.001500	.000167	.....	.....	
10,500	42,000	.001667	.000167	.000100	.000100	
10,750	43,000	.001733	.000066	.....	.....	Elastic limit.
11,000	44,000	.003333	.001600	.....	.....	
11,250	45,000	.005367	.002034	.....	.....	
11,500	46,000	.006500	.001133	.....	.....	
11,750	47,000	.007667	.001167	.....	.....	
12,000	48,000	.008867	.001000	.....	.....	
20,600	82,400	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	82,400
Elastic limit per square inch of original section	do...	43,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″ from neck
Character of broken surface		silky, trace of granulation
Elongation of inch sections		″.35, ″.16, ″.11

TUBE.

No. 5001.

Marks, $\frac{4924\ B_1}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001433	0.	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001533	.000066	.....	.....	
12,000	48,000	.001600	.000067	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	
12,500	50,000	.001667	.000034	.....	.....	
12,750	51,000	.001667	0.	.....	.....	
13,000	52,000	.001700	.000033	.....	.....	
13,250	53,000	.001733	.000033	.....	.....	Elastic limit.
13,500	54,000	.003000	.001267	.....	.....	
13,750	55,000	.005000	.002000	.....	.....	
14,000	56,000	.006333	.001333	.....	.....	
14,250	57,000	.007333	.001000	.....	.....	
14,500	58,000	.008333	.001000	.....	.....	
23,420	93,680	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	93,680
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.1 from neck
Character of broken surface		silky
Elongation of inch sections		″.32*, ″.18, ″.11

TUBE.

No. 5000.

Marks, $\frac{4924\ B_1}{M\ T,\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	001433	.000033	.....	.....	
11,250	45,000	.001500	.000067	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	Elastic limit.
12,750	51,000	.002333	.000633	.....	.....	
13,000	52,000	.006667	.004334	.....	.....	
13,250	53,000	.007667	.001000	.....	.....	
13,500	54,000	.008667	.001000	.....	.....	
13,750	55,000	.009500	.000833	.....	.....	
22,070	88,280	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,280
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1".3 from neck
Character of broken surface		silky, oblique
Elongation of inch sections		".12, ".37*, ".18

TUBE.

No. 5011.

Marks, $\frac{4925\ B_1}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001533	.000033	.....	.....	Elastic limit.
12,000	48,000	.003333	.001800	.....	.....	
12,250	49,000	.004500	.001167	.....	.....	
12,500	50,000	.006167	.001667	.....	.....	
12,750	51,000	.007000	.000833	.....	.....	
13,000	52,000	.008000	.001000	.....	.....	
21,170	84,680	.1367	.1287	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,680
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2567
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.16, ″.45*, ″.16

TUBE.

No. 5010.

Marks, $\frac{4925\ B,}{M\ T,\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001333	.000200	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001667	.000067	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	
12,500	50,000	.001733	.000033	.....	.....	
12,750	51,000	.001767	.000034	.....	.....	
13,000	52,000	.001800	.000033	.....	.....	
13,250	53,000	.001833	.000033	.....	.....	Elastic limit.
13,500	54,000	.010000	.008167	.....	.....	
13,750	55,000	.010400	.000400	.....	.....	
14,000	56,000	.011000	.000600	.....	.....	
14,250	57,000	.011600	.000600	.....	.....	
14,500	58,000	.012667	.001067	.....	.....	
22,070	88,280	.1467	.134033	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,280
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001833
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		".85 from neck
Character of broken surface		silky, 60 per cent of surface interspersed with fine granulation
Elongation of inch sections		".33+," .17, ".12

TUBE No. 28.

No. 5188.

Marks, $\frac{8\ R_{28}\ T}{B\ T_4\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001333	.000033	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001533	.000033	.....	.....	
12,250	49,000	.001600	.000067	.....	.....	
12,500	50,000	.001633	.000033	.....	.....	
12,750	51,000	.001667	.000034	.....	.....	Elastic limit.
13,000	52,000	.002667	.001000	.....	.....	
13,250	53,000	.003167	.000500	.....	.....	
13,500	54,000	.004333	.001166	.....	.....	
13,750	55,000	.007333	.003000	.....	.....	
14,000	56,000	.010333	.003000	.....	.....	
22,120	88,480	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,480
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		″1.6 from neck
Character of broken surface		silky
Elongation of inch sections		″.14, ″.88*, ″.10

TUBE NO. 28.

No. 5189.

Marks, $\frac{8\ R_{28}\ T}{M\ T_4\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	Elastic limit.
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.011333	.009666	.....	.....	
12,750	51,000	.013000	.001667	.....	.....	
13,000	52,000	.014000	.001000	.....	.....	
13,250	53,000	.015000	.001000	.....	.....	
21,040	84,160	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,160
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		86.4
Position of rupture		1″.5 from neck
Character of broken surface		silky
Elongation of inch sections		″.21, ″.33*, ″.14

TUBE No. 29.

No. 5190.

Marks, $\frac{8\ R_e\ T}{B\ T_1\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001333	.000033	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001467	.000067	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	Elastic limit.
11,750	47,000	.002000	.000467	.....	.....	
12,000	48,000	.004667	.002667	.....	.....	
12,250	49,000	.006667	.002000	.....	.....	
12,500	50,000	.008000	.001333	.....	.....	
12,750	51,000	.008667	.000667	.....	.....	
21,360	85,440	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,440
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.5 from neck
Character of broken surface		silky
Elongation of inch sections		″.11, ″.87*, ″.15

TUBE NO. 29.

No. 5191.

Marks, $\frac{S\,R_2\,T}{M\,T_1\,I}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001267	.000167	.....	.....	
10,500	42,000	.001333	.000066	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001400	0.	.....	.....	
11,500	46,000	.001433	.000033	.....	.....	
11,750	47,000	.001467	.000034	.....	.....	
12,000	48,000	.001500	.000033	.....	.....	
12,250	49,000	.001567	.000067	.....	.....	
12,500	50,000	.001600	.000033	.....	.....	
12,750	51,000	.001633	.000033	.....	.....	
13,000	52,000	.001667	.000034	.....	.....	
13,250	53,000	.001700	.000033	.....	.....	Elastic limit.
13,500	54,000	.012333	.010633	.....	.....	
13,750	55,000	.013000	.000667	.....	.....	
14,000	56,000	.013700	.000700	.....	.....	
14,250	57,000	.014667	.000967	.....	.....	
14,500	58,000	.015833	.001166	.....	.....	
21,760	87,040	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,040
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.094
Reduction in area after rupture, per cent of original section		30.6
Position of rupture		1". 19 from neck
Character of broken surface		granular, 85 per cent; dull flaky, 15 per cent
Elongation of inch sections		".19*, ".26*, ".12

JACKET NO. 23.

No. 4988.

Marks, 8 R J / B T 1 O
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	....	....	
2,500	10,000	.000300	.000233	....	....	
5,000	20,000	.000633	.000333	....	....	
7,500	30,000	.000967	.000334	....	....	
10,000	40,000	.001333	.000366	0.	....	
11,000	44,000	.001400	.000067	0.	....	
11,250	45,000	.001467	.000067	....	....	
11,500	46,000	.001533	.000066	....	....	
11,750	47,000	.001567	.000034	....	....	
12,000	48,000	.001600	.000033	....	....	
12,250	49,000	.001633	.000033	....	....	
12,500	50,000	.001667	.000034	....	....	
12,750	51,000	.001667	0.	....	....	
13,000	52,000	.001700	.000033	....	....	
13,250	53,000	.001733	.000033	....	....	
13,500	54,000	.001767	.000034	....	....	
13,750	55,000	.001833	.000066	....	....	
14,000	56,000	.001900	.000067	....	....	
14,250	57,000	.001967	.000067	....	....	
14,500	58,000	.002000	.000033	....	....	
14,750	59,000	.002067	.000067	....	....	Elastic limit.
15,000	60,000	.002233	.000166	....	....	
15,250	61,000	.002400	.000167	....	....	
15,500	62,000	.002933	.000533	....	....	
15,750	63,000	.0J4067	.001134	....	....	
16,000	64,000	.005533	.001466	....	....	
24,650	98,600	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section....................................pounds.. 98,600
Elastic limit per square inch of original section ....do... 59,000
Elongation per inch after rupture...inch.. .1833
Elongation per inch under strain at elastic limit ....do... .002067
Reduction in diameter at point of rupture......................................do... .114
Reduction in area after rupture, per cent of original section.................................. 36.4
Position of rupture.. ″.84 from neck
Character of broken surface .... granular, 60 per cent; silky, 40 per cent
Elongation of inch sections.. ″.28*, ″.14, ″.13

JACKET No. 23.

No. 4989.

Marks, $^{8\ R\ J}_{M\ T\ 1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	....	
2,500	10,000	.000233	.000166	....	....	
5,000	20,000	.000600	.000367	....	....	
7,500	30,000	.000900	.000300	....	....	
10,000	40,000	.001267	.000367	0.	....	
11,000	44,000	.001367	.000100	0.	....	
11,250	45,000	.001400	.000033	....	....	
11,500	46,000	.001400	0.	....	....	
11,750	47,000	.001433	.000033	....	....	
12,000	48,000	.001500	.000067	....	....	
12,250	49,000	.001600	.000100	....	....	
12,500	50,000	.001667	.000067	....	....	Elastic limit.
12,750	51,000	.003000	.001333	....	....	
13,000	52,000	.005333	.002333	....	....	
13,250	53,000	.006433	.001100	....	....	
13,500	54,000	.007600	.001167	....	....	
13,750	55,000	.008667	.001067	....	....	
21,750	87,000	....	....	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,000
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		″.28 from neck
Character of broken surface		silky
Elongation of inch sections		″.14, ″.33*, ″.23

JACKET.

No. 5003.

Marks, $\frac{5104\ B}{B\ T, M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
11,000	44,000	.001433	.000100	0.	.....	
11,250	45,000	.001500	.000067	.....	.....	
11,500	46,000	.001533	.000033	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	
12,000	48,000	.001600	.000033	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	
12,500	50,000	.001667	.000034	.....	.....	
12,750	51,000	.001700	.000033	.....	.....	Elastic limit.
13,000	52,000	.002667	.000967	.....	.....	
13,250	53,000	.004333	.001666	.....	.....	
13,500	54,000	.006000	.001667	.....	.....	
13,750	55,000	.007167	.001167	.....	.....	
14,000	56,000	.008167	.001000	.....	.....	
22,980	91,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds.	91,920
Elastic limit per square inch of original section	do..	51,000
Elongation per inch after rupture	inch..	.1767
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1". 23 from neck
Character of broken surface		silky
Elongation of inch sections		".23*, ".20*, ".10

JACKET.

No. 5002.

Marks, $\frac{5104\ B}{M\ T,\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
10,000	40,000	.001300	.000367	0.	.....	
11,000	44,000	.001433	.000133	0.	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001467	0.	.....	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001567	.000067	.....	.....	
12,250	49,000	.001667	.000100	.....	.....	
12,500	50,000	.001733	.000066	.....	.....	Elastic limit.
12,750	51,000	.002333	.000600	.....	.....	
13,000	52,000	.003333	.001000	.....	.....	
13,250	53,000	.004667	.001334	.....	.....	
13,500	54,000	.006667	.002000	.....	.....	
13,750	55,000	.008333	.001666	.....	.....	
22,460	89,840	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,840
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.1900
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		″.6 from neck
Character of broken surface		silky
Elongation of inch sections		″.35*, ″.11, ″.11

JACKET NO. 26.

No. 5021.

Marks, $^{8R_3J}_{BT_1O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	....	
2,500	10,000	.000267	.000200	....	....	
5,000	20,000	.000600	.000333	....	....	
7,500	30,000	.000967	.000367	....	....	
10,000	40,000	.001300	.000333	0.	....	
11,000	44,000	.001433	.000133	0.	....	
11,250	45,000	.001467	.000034	....	....	
11,500	46,000	.001500	.000033	....	....	
11,750	47,000	.001500	0.	....	....	
12,000	48,000	.001533	.000033	....	....	
12,250	49,000	.001600	.000067	....	....	
12,500	50,000	.001667	.000067	....	....	
12,750	51,000	.001700	.000033	....	....	
13,000	52,000	.001733	.000033	....	....	
13,250	53,000	.001767	.000034	....	....	Elastic limit.
13,500	54,000	.006333	.004566	....	....	
13,750	55,000	.006767	.000433	....	....	
14,000	56,000	.007667	.000900	....	....	
14,250	57,000	.008667	.001000	....	....	
14,500	58,000	.010000	.001333	....	....	
22,910	91,640	.1467	.1367	....	....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,640
Elastic limit per square inch of original section	do...	58,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		″.80 from neck
Character of broken surface		granular, 60 per cent; silky, 40 per cent
Elongation of inch sections		″.14, ″.17, ″.31*

JACKET No. 26.

No. 5022.

Marks, $\frac{S\ R_{es}\ J}{M\ T,\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001267	.000300	0.	.....	
11,000	44,000	.001433	.000166	0.	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	Elastic limit.
11,750	47,000	.001600	.000100	.....	.....	
12,000	48,000	.005400	.003800	.....	.....	
12,250	49,000	.008333	.002933	.....	.....	
12,500	50,000	.010000	.001667	.....	.....	
12,750	51,000	.011333	.001333	.....	.....	
21,120	84,480	.1400	.128667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds...	84,480
Elastic limit per square inch of original section	do....	46,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do....	.001500
Reduction in diameter at point of rupture	do....	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		″.75 from neck
Character of broken surface		silky
Elongation of inch sections		″.40*, ″.17, ″.11

JACKET.

No. 5182.

Marks, $\frac{5149\ B}{B\ T,\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001300	.000333	0.	.....	
11,000	44,000	.001433	.000133	0.	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	Elastic limit.
13,000	52,000	.002333	.000600	.....	.....	
13,250	53,000	.005667	.003334	.....	.....	
13,500	54,000	.007000	.001333	.....	.....	
13,750	55,000	.007667	.000667	.....	.....	
14,000	56,000	.008833	.001166	.....	.....	
22,660	90,640	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,640
Elastic limit per square inch of original section	do ..	51,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do....	.001733
Reduction in diameter at point of rupture	do....	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		".14, ".37*, ".14

JACKET.

No. 5181.

Marks, $\frac{5149\ B}{M\ T, M}$,
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40.000	.001333	.000366	0.	.....	
11,000	44,000	.001433	.000100	0.	.....	
11,250	45.000	.001467	.000034	.....	.....	
11,500	46.000	.001500	.000033	.....	.....	
11,750	47,000	.001567	.000067	.....	.....	
12,000	48,000	.001600	.000033	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	
12,500	50,000	.001667	.000034	.....	.....	
12,750	51,000	.001733	.000066	.....	.....	Elastic limit.
13,000	52,000	.004000	.002267	.....	.....	
13,250	53,000	.006000	.002000	.....	.....	
13,500	54,000	.007333	.001333	.....	.....	
13,750	55,000	.008333	.001000	.....	.....	
14,000	56,000	.009667	.001334	.....	.....	
22,490	89,960	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,960
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.28 from neck
Character of broken surface		silky
Elongation of inch sections		″.28*, ″.24*, ″.11

JACKET No. 28.

No. 5183.

Marks, $\frac{8\ R\ J}{B\ T\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000267	.000167	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
10,000	40,000	.001267	.000334	0.	.....	
11,000	44,000	.001400	.000133	0.	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001533	.000033	.....	.....	
12,250	49,000	.001567	.000034	.....	.....	
12,500	50,000	.001600	.000033	.....	.....	
12,750	51,000	.001667	.000067	.....	.....	Elastic limit.
13,000	52,000	.002333	.000666	.....	.....	
13,250	53,000	.004667	.002334	.....	.....	
13,500	54,000	.005667	.001000	.....	.....	
13,750	55,000	.006500	.000833	.....	.....	
14,000	56,000	.007533	.001033	.....	.....	
22,880	91,520	.1233	.115767	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,520
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		″.7 from neck
Character of broken surface		silky
Elongation of inch sections		″.11, ″.15, ″.37

JACKET No. 28.

No. 5184.

Marks, $\frac{S\ R_{TR}\ J}{M\ T_1\ I}$
Diameter, $''.564$.
Sectional area, .25 square inch.
Gauged length, $3''$.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001267	.000300	0.	.....	
11,000	44,000	.001400	.000133	0.	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001533	.000033	.....	.....	
12,250	49,000	.001567	.000034	.....	.....	
12,500	50,000	.001600	.000033	.....	.....	
12,750	51,000	.001633	.000033	.....	.....	
13,000	52,000	.001667	.000034	.....	.....	
13,250	53,000	.001700	.000033	.....	.....	
13,500	54,000	.001733	.000033	.....	.....	
13,750	55,000	.001767	.000034	.....	.....	
14,000	56,000	.001800	.000033	.....	.....	
14,250	57,000	.001867	.000067	.....	.....	Elastic limit.
14,500	58,000	.003667	.001800	.....	.....	
14,750	59,000	.006667	.003000	.....	.....	
15,000	60,000	.008333	.001666	.....	.....	
15,250	61,000	.008667	.000334	.....	.....	
15,500	62,000	.009833	.001166	.....	.....	
23,660	94,640	.1267	.116867	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	94,640
Elastic limit per square inch of original section	do...	57,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.001867
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		".8 from neck
Character of broken surface		silky
Elongation of inch sections		".12, ".16, ".35*

TABULATION OF TENSION SPECIMENS FROM 8-INCH STEEL B. L. RIFLES.

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds	*Pounds*	*P. ct.*	*P. ct.*		
4998	Tube No. 25	.....	.....	87,600	18.0	33.5	Silky, serrated	Breech end.
4999	do	.....	43,000	82,400	20.7	47.2	Silky, trace of granulation.	Muzzle end.
5001	Tube	Middle.	53,000	93,680	20.3	47.2	Silky	Breech end.
5000	do	do	50,000	88,280	22.3	49.7	Silky, oblique	Muzzle end.
5011	do	do	47,000	84,680	25.7	54.6	Silky	Breech end.
5010	do	do	53,000	88,280	20.7	44.6	Silky and fine granular.	Muzzle end.
5188	Tube No. 28	Inside	51,000	88,480	20.7	49.7	Silky	Breech end.
5189	do	do	48,000	84,160	22.7	36.4	do	Muzzle end.
5190	Tube No. 29	do	46,000	85,440	21.0	44.6	do	Breech end.
5191	do	do	53,000	87,040	19.0	30.6	Granular, 85 per cent; dull flaky, 15 per cent.	Muzzle end.
4988	Jacket No. 23	Outside	59,000	98,600	18.3	36.4	Granular, 60 per cent; silky, 40 per cent.	Breech end.
4989	do	do	50,000	87,000	23.3	49.7	Silky	Muzzle end.
5003	Jacket	Middle.	51,000	91,920	17.7	49.7	do	Breech end.
5002	do	do	50,000	89,840	19.0	49.7	do	Muzzle end.
5021	Jacket No. 26	Outside	53,000	91,640	20.7	39.2	Granular, 60 per cent; silky, 40 per cent.	Breech end.
5022	do	do	46,000	84,480	22.7	52.2	Silky	Muzzle end.
5182	Jacket	Middle.	51,000	90,640	21.7	41.9	do	Breech end.
5181	do	do	51,000	89,960	21.0	49.7	do	Muzzle end.
5183	Jacket No. 28	Inside	51,000	91,520	21.0	49.7	do	Breech end.
5184	do	do	57,000	94,640	21.0	47.2	do	Muzzle end.

10-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES AND JACKETS.

TUBE.

No. 4940.

Marks, $\frac{4714\,B_1}{B\,T_2M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001833	.000200	0.	.....	
10,250	41,000	.001333	0.	.....	.....	
10,500	42,000	.001400	.000067	.....	.....	Elastic limit.
10,750	43,000	.001533	.000133	.....	.....	
11,000	44,000	.001700	.000167	.....	.....	
11,250	45,000	.002567	.000867	.....	.....	
11,500	46,000	.003300	.000733	.....	.....	
11,750	47,000	.004100	.000800	.....	.....	
21,600	86,400	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,400
Elastic limit per square inch of original section	do...	42,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001400
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.18 from neck
Character of broken surface		fine, silky
Elongation of inch sections		″.38, ″.21, ″.14

TUBE.

No. 4939.

Marks, $\frac{4714\ B}{M\ T, M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001333	.000200	0.	.....	
10,250	41,000	.001333	0.	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001467	.000067	.....	.....	
11,250	45,000	.001533	.000066	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001667	.000067	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	Elastic limit.
12,500	50,000	.001900	.000200	.....	.....	
12,750	51,000	.002300	.000400	.....	.....	
13,000	52,000	.003000	.000700	.....	.....	
13,250	53,000	.003800	.000800	.....	.....	
13,500	54,000	.004733	.000933	.....	.....	
22,900	91,600	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,600
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.1667
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.07 from neck
Character of broken surface		fine, silky
Elongation of inch sections		″.08, ″.17, ″.25*

TUBE.

No. 4979.

Marks, $\frac{5104\ B}{B\ T,\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001200	.000233	0.	.....	
10,000	40,000	.001333	.000133	0.	.....	
10,250	41,000	.001333	0.	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001367	0.	.....	.....	
11,000	44,000	.001433	.000066	.....	.....	
11,250	45,000	.001500	.000067	.....	.....	Elastic limit.
11,500	46,000	.001767	.000267	.....	.....	
11,750	47,000	.002400	.000633	.....	.....	
12,000	48,000	.003267	.000867	.....	.....	
12,250	49,000	.004000	.000733	.....	.....	
12,500	50,000	.004967	.000967	.....	.....	
22,900	91,600	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,600
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch...	.2067
Elongation per inch under strain at elastic limit	do...	.001500
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1″.42 from neck
Character of broken surface		granular, 50 per cent; silky, 50 per cent
Elongation of inch sections		″.20, ″.30*, ″.12

TUBE.

No. 4978.

Marks, $\frac{5104\ B}{M\ T, M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001233	.000200	0.	.....	
10,000	40,000	.001367	.000134	.000033	.000033	
10,250	41,000	.001400	.000033	.....	.....	
10,500	42,000	.001433	.000033	.....	.....	
10,750	43,000	.001500	.000067	.....	.....	
11,000	44,000	.001567	.000067	.....	.....	
11,250	45,000	.001600	.000033	.....	.....	
11,500	46,000	.001633	.000033	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	
12,000	48,000	.001667	0.	.....	.....	
12,250	49,000	.001667	0.	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001767	.000034	.....	.....	Elastic limit.
13,250	53,000	.001900	.000133	.....	.....	
13,500	54,000	.003500	.001600	.....	.....	
13,750	55,000	.006267	.002767	.....	.....	
14,000	56,000	.007333	.001066	.....	.....	
14,250	57,000	.008500	.001167	.....	.....	
22,500	90,000	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,000
Elastic limit per square inch of original section	do...	52,000
Elongation per inch after rupture	inch...	.2233
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.21 from neck
Character of broken surface		granular, 40 per cent; silky, 60 per cent
Elongation of inch sections		″.38, ″.25, ″.14

TUBE.

No. 4993.

Marks, $\frac{5143\ B_1}{B\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000600	.000300	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001033	.000100	0.	.....	
10,000	40,000	.001300	.000267	0.	.....	
10,250	41,000	.001300	0.	.....	.....	
10,500	42,000	.001333	.000033	.....	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001367	0.	.....	.....	
11,250	45,000	.001400	.000033	.....	.....	
11,500	46,000	.001433	.000033	.....	.....	Elastic limit.
11,750	47,000	.003333	.001900	.....	.....	
12,000	48,000	.005100	.001767	.....	.....	
12,250	49,000	.006134	.001033	.....	.....	
12,500	50,000	.007167	.001034	.....	.....	
12,750	51,000	.008167	.001000	.....	.....	
21,550	86,200	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,200
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2433
Elongation per inch under strain at elastic limit	do...	.001433
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1". 44 from neck
Character of broken surface		fine, silky
Elongation of inch sections		". 16, ". 37*, ". 20

TUBE.

No. 4992.

Marks, $\frac{5143\ B}{M\ T, M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000033	.000033	0.	.....	
2,500	10,000	.000267	.000234	.....	.....	
5,000	20,000	.000567	.000300	.....	.....	
7,500	30,000	.000900	.000333	.....	.....	
8,750	35,000	.001000	.000100	0.	.....	
10,000	40,000	.001233	.000233	0.	.....	
10,250	41,000	.001300	.000067	.....	.....	
10,500	42,000	.001300	0.	.....	.....	
10,750	43,000	.001333	.000033	.....	.....	
11,000	44,000	.001333	0.	.....	.....	
11,250	45,000	.001367	.000034	.....	.....	
11,500	46,000	.001400	.000033	.....	.....	
11,750	47,000	.001433	.000033	.....	.....	Elastic limit.
12,000	48,000	.001533	.000100	.....	.....	
12,250	49,000	.001633	.000100	.....	.....	
12,500	50,000	.003133	.001500	.....	.....	
12,750	51,000	.005300	.002167	.....	.....	
13,000	52,000	.006267	.000967	.....	.....	
13,250	53,000	.007300	.001033	.....	.....	
13,500	54,000	.008333	.001033	.....	.....	
22,200	88,800	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,800
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.001433
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.24 from neck
Character of broken surface		fine, silky
Elongation of inch sections		″.24, ″.32*, ″.13

TUBE.

No. 5005.

Marks, $\frac{4833\ B}{B\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001333	.000200	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001433	0.	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	
12,000	48,000	.001667	.000067	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	Elastic limit.
12,500	50,000	.003667	.001967	.....	.....	
12,750	51,000	.005000	.001333	.....	.....	
13,000	52,000	.006333	.001333	.....	.....	
13,250	53,000	.007333	.001000	.....	.....	
13,500	54,000	.008333	.001000	.....	.....	
22,340	89,360	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,360
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2123
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1".5 from neck
Character of broken surface		silky
Elongation of inch sections		".16, ".36*, ".12

TUBE.

No. 5004.

Marks, $\frac{4833\ B_1}{M\ T_2\ M}$
Diameter, $''.564$
Sectional area, .25 square inch.
Gauged length, $3''$.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Poimds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001333	.000200	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001367	0.	.....	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001533	.000033	.....	.....	Elastic limit.
12,000	48,000	.001700	.000167	.....	.....	
12,250	49,000	.003000	.001300	.....	.....	
12,500	50,000	.006000	.003000	.....	.....	
12,750	51,000	.006667	.000667	.....	.....	
13,000	52,000	.008000	.001333	.....	.....	
21,640	86,560	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,560
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		$1''.5$ from neck
Character of broken surface		silky
Elongation of inch sections		$''.12, ''.37^*, ''.18$

TUBE.

No. 5020.

Marks, $\frac{5148\ B_2}{B\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000300	.000200			
5,000	20,000	.000667	.000367			
7,500	30,000	.001000	.000333			
8,750	35,000	.001200	.000200	0.		
10,000	40,000	.001333	.000133	0.		
10,250	41,000	.001367	.000034			
10,500	42,000	.001400	.000033			
10,750	43,000	.001433	.000033			
11,000	44,000	.001467	.000034			
11,250	45,000	.001533	.000066			
11,500	46,000	.001600	.000067			
11,750	47,000	.001667	.000067			Elastic limit.
12,000	48,000	.001833	.000166			
12,250	49,000	.004333	.002500			
12,500	50,000	.006500	.002167			
12,750	51,000	.007333	.000833			
13,000	52,000	.008500	.001167			
21,510	86,040	.1400	.1315			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,040
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2400
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		".15, ".44*, ".13

TUBE.

No. 5019.

Marks, $\frac{5148\ B}{M\ T,\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001167	.000200	0.	.....	
10,000	40,000	.001333	.000166	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001400	0.	.....	.....	
11,000	44,000	.001467	.000067	.....	.....	
11,250	45,000	.001533	.000066	.....	.....	
11,500	46,000	.001633	.000100	.....	.....	Elastic limit.
11,750	47,000	.002000	.000367	.....	.....	
12,000	48,000	.003000	.001000	.....	.....	
12,250	49,000	.004167	.001167	.....	.....	
12,500	50,000	.005667	.001500	.....	.....	
12,750	51,000	.006667	.001000	.....	.....	
21,490	85,960	.1333	.126633	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,960
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch .	.2300
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1".5 from neck
Character of broken surface		silky
Elongation of inch sections		", 18, ".37*, ".19

TUBE NO. 11.

No. 5185.

Marks, $\frac{10\ R_{11}\ T}{B\ T_2\ I}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000967	.000367	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	Elastic limit.
11,250	45,000	.004000	.002567	.....	.....	
11,500	46,000	.007500	.003500	.....	.....	
11,750	47,000	.008333	.000833	.....	.....	
12,000	48,000	.009467	.001134	.....	.....	
12,250	49,000	.010400	.000933	.....	.....	
19,860	79,440	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	79,440
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001433
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1".1 from neck
Character of broken surface		silky
Elongation of inch sections		".33, ".24, ".13

TUBE NO. 11.

No. 5186.

Marks, $\frac{10\ R_{II}\ T}{M\ T,\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
8,750	35,000	.001200	.000167	.000033	.000033	
10,000	40,000	.001267	.000167	.000033	0.	
10,250	41,000	.001400	.000033	.....	.....	
10,500	42,000	.001433	.000033	.....	.....	Elastic limit.
10,750	43,000	.001600	.000167	.....	.....	
11,000	44,000	.004000	.002400	.....	.....	
11,250	45,000	.015333	.011333	.....	.....	
11,500	46,000	.016667	.001334	.....	.....	
11,750	47,000	.017500	.000833	.....	.....	
20,190	80,760	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	80,760
Elastic limit per square inch of original section	do...	42,000
Elongation per inch after rupture	inch..	.1833
Elongation per inch under strain at elastic limit	do...	.001433
Reduction in diameter at point of rupture	do...	.084
Reduction in area after rupture, per cent of original section		27.6
Position of rupture		1″ from neck
Character of broken surface		granular, 90 per cent; silky, 10 per cent
Elongation of inch sections		″.11, ″.18, ″.26*

TUBE No. 12.

No. 5160.

Marks, $\frac{10\ R_{12}\ T}{B\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000200	.000200	0.	.....	
2,500	10,000	.000367	.000167	.....	.....	
5,000	20,000	.000767	.000400	.....	.....	
7,500	30,000	.001067	.000300	.....	.....	
8,750	35,000	.001300	.000233	.000033	.000033	
10,000	40,000	.001400	.000100	0.	—.000033	
10,250	41,000	.001433	.000033	.....	.....	
10,500	42,000	.001500	.000067	.....	.....	
10,750	43,000	.001533	.000033	.....	.....	
11,000	44,000	.001600	.000067	.....	.....	
11,250	45,000	.001633	.000033	.....	.....	
11,500	46,000	.001667	.000034	.....	.....	
11,750	47,000	.001667	0.	.....	.....	
12,000	48,000	.001700	.000033	.....	.....	
12,250	49,000	.001700	0.	.....	.....	
12,500	50,000	.001733	.000033	.....	.....	
12,750	51,000	.001767	.000034	.....	.....	
13,000	52,000	.001833	.000066	.....	.....	
13,250	53,000	.001867	.000034	.....	.....	
13,500	54,000	.001967	.000100	.....	.....	
13,750	55,000	.001967	0.	.....	.....	
14,000	56,000	.002000	.000033	.....	.....	
14,250	57,000	.002000	0.	.....	.....	
14,500	58,000	.002033	.000033	.....	.....	Elastic limit.
14,750	59,000	.009667	.007634	.....	.....	
15,000	60,000	.010167	.000500	.....	.....	
15,250	61,000	.011000	.000833	.....	.....	
15,500	62,000	.012000	.001000	.....	.....	
15,750	63,000	.012833	.000833	.....	.....	
22,820	95,280	.1200	.107167	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,280
Elastic limit per square inch of original section	do...	58,000
Elongation per inch after rupture	inch..	.1933
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.95 from neck
Character of broken surface		silky
Elongation of inch sections		″.11, ″.36*, ″.11

Chemical composition.

	Per cent.
Total carbon	0.471
Graphitic carbon	0.020
Combined carbon	0.451
Manganese	0.732
Silicon	0.190
Sulphur	0.029
Phosphorus	0.025
Copper	0.000

TUBE NO. 12.

No. 5161.

Marks, $\frac{10\ R_1\ T}{M\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000600	.000300	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001033	.000100	0.	.....	
10,000	40,000	.001300	.000267	0.	.....	Elastic limit.
10,250	41,000	.001500	.000200	.....	.....	
10,500	42,000	.012000	.010500	.....	.....	
10,750	43,000	.013667	.001667	.....	.....	
11,000	44,000	.014667	.001000	.....	.....	
11,250	45,000	.015333	.000666	.....	.....	
19,720	78,880	.1700	.154667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	78,880
Elastic limit per square inch of original section	do...	40,000
Elongation per inch after rupture	inch..	.2400
Elongation per inch under strain at elastic limit	do...	.001300
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1″.65 from neck
Character of broken surface		silky, 40 per cent of surface interspersed with fine granulation
Elongation of inch sections		″.18, ″.36*, ″.18

Chemical composition.

	Per cent.
Total carbon	0.500
Graphitic carbon	0.021
Combined carbon	0.479
Manganese	0.737
Silicon	0.190
Sulphur	0.027
Phosphorus	0.026
Copper	0.000

TUBE NO. 13.

No. 5163.

Marks, $\frac{10\ R_{18}\ T}{B\ T_{1}\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001367	0.	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001467	.000067	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	Elastic limit.
12,000	48,000	.002833	.001233	.....	.....	
12,250	49,000	.005000	.002167	.....	.....	
12,500	50,000	.006833	.001833	.....	.....	
12,750	51,000	.007267	.000434	.....	.....	
13,000	52,000	.008333	.001066	.....	.....	
21,420	85,680	.1800	.171667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,680
Elastic limit per square inch of original section	....do...	47,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		″.4 from neck
Character of broken surface		silky
Elongation of inch sections		″.17, ″.35*, ″.11

TUBE NO. 13.

No. 5164.

Marks, $\frac{10\ R_{18}\ T}{M\ T_1\ O}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	0.	.....	
10,250	41,000	.001333	0.	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	Elastic limit.
11,750	47,000	.001667	.000134	.....	.....	
12,000	48,000	.013667	.012000	.....	.....	
12,250	49,000	.015000	.001333	.....	.....	
12,500	50,000	.016000	.001000	.....	.....	
12,750	51,000	.016667	.000667	.....	.....	
20,020	80,080	.1633	.146633	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	80,080
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		".7 from neck
Character of broken surface		silky
Elongation of inch sections		".40*, ".18, ".10

TUBE No. 14.

No. 5165.

Marks, $^{10\,B_{14}\,T}_{B\,T_1\,O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.		
2,500	10,000	.000300	.000200			
5,000	20,000	.000633	.000333			
7,500	30,000	.000967	.000334			
8,750	35,000	.001100	.000133	0.		
10,000	40,000	.001300	.000200	0.		
10,250	41,000	.001333	.000033			
10,500	42,000	.001367	.000034			
10,750	43,000	.001400	.000033			
11,000	44,000	.001433	.000033			
11,250	45,000	.001467	.000034			
11,500	46,000	.001533	.000066			
11,750	47,000	.001567	.000034			Elastic limit.
12,000	48,000	.002000	.000433			
12,250	49,000	.002633	.000633			
12,500	50,000	.003433	.000800			
12,750	51,000	.004200	.000767			
13,000	52,000	.005333	.001133			
21,980	87,920	.1033	.097967			Tensile strength.

General summary.

Tensile strength per square inch of original section ......pounds..	87,920
Elastic limit per square inch of original section ......do...	47,000
Elongation per inch after rupture ......inch..	.1633
Elongation per inch under strain at elastic limit ......do...	.001567
Reduction in diameter at point of rupture ......do...	.154
Reduction in area after rupture, per cent of original section	47.2
Position of rupture	″.70 from neck
Character of broken surface	silky
Elongation of inch sections	″.05, ″.10, ″.34*

TUBE No. 14.

No. 5166.

Marks, $\frac{10\ B_{14}\ T}{M\ T_1\ O}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000267	.000167	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001067	.000134	0.	.....	
10,000	40,000	.001233	.000166	0.	.....	
10,250	41,000	.001267	.000034	.....	.....	
10,500	42,000	.001300	.000033	.....	.....	
10,750	43,000	.001333	.000033	.....	.....	
11,000	44,000	.001367	.000034	.....	.....	
11,250	45,000	.001400	.000033	.....	.....	
11,500	46,000	.001433	.000033	.....	.....	
11,750	47,000	.001500	.000067	.....	.....	
12,000	48,000	.001567	.000067	.....	.....	Elastic limit.
12,250	49,000	.012000	.010433	.....	.....	
12,500	50,000	.012833	.000833	.....	.....	
12,750	51,000	.013500	.000667	.....	.....	
13,000	52,000	.014667	.001167	.....	.....	
13,250	53,000	.015667	.001000	.....	.....	
20,030	80,120	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	80,120
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001567
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1".4 from neck
Character of broken surface		silky
Elongation of inch sections		".21, ".37*, ".12

TUBE NO. 15.

No. 5177.

Marks, $\frac{10\ R_{15}\ T}{B\ T_4\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001333	0.	.....	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001500	.000067	.....	.....	
11,750	47,000	.001533	.000033	.....	.....	
12,000	48,000	.001567	.000034	.....	.....	
12,250	49,000	.001633	.000066	.....	.....	
12,500	50,000	.001667	.000034	.....	.....	
12,750	51,000	.001700	.000033	.....	.....	Elastic limit.
13,000	52,000	.001900	.000200	.....	.....	
13,250	53,000	.002033	.000133	.....	.....	
13,500	54,000	.002267	.000234	.....	.....	
13,750	55,000	.002833	.000566	.....	.....	
14,000	56,000	.005000	.002167	.....	.....	
21,020	84,080	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,080
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.1033
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.044
Reduction in area after rupture, per cent of original section		15.0
Position of rupture		1″.4 from neck
Character of broken surface		granular, 80 per cent; dull flaky, 20 per cent
Elongation of inch sections		″.08, ″.15*, ″.08

TUBE NO. 15.

No. 5178.

Marks, $\frac{10\ R_{15}\ T}{M\ T_A\ I}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001333	.000133	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	Elastic limit.
11,500	46,000	.015000	.013500	.....	.....	
11,750	47,000	.015600	.000600	.....	.....	
12,000	48,000	.016400	.000800	.....	.....	
12,250	49,000	.017067	.000667	.....	.....	
12,500	50,000	.018000	.000933	.....	.....	
20,940	83,760	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	83,760
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.1533
Elongation per inch under strain at elastic limit	do...	.001500
Reduction in diameter at point of rupture	do...	.054
Reduction in area after rupture, per cent of original section		18.3
Position of rupture		"8 from neck
Character of broken surface		granular, with a small flaky spot
Elongation of inch sections		".11, ".17, ".18*

TUBE.

No. 5194.

Marks, $\frac{4951\ B_7}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001467	.000067	.....	.....	
11,000	44,000	.001500	.000033	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001767	.000034	.....	.....	Elastic limit.
13,250	53,000	.001933	.000166	.....	.....	
13,500	54,000	.007000	.005067	.....	.....	
13,750	55,000	.007833	.000833	.....	.....	
14,000	56,000	.009000	.001167	.....	.....	
14,250	57,000	.009833	.000833	.....	.....	
22,550	90,200	.1400	.130167	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,200
Elastic limit per square inch of original section	do...	52,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		89.2
Position of rupture		at middle of stem
Character of broken surface		fine granular, 60 per cent; silky, 40 per cent
Elongation of inch sections		″.13, ″.36*, ″.12

TUBE.

No. 5193.

Marks, $\frac{4951\ B_1}{M\ T_1\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001367	0.	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001500	.000067	.....	.....	
11,750	47,000	.001533	.000033	.....	.....	
12,000	48,000	.001567	.000034	.....	.....	
12,250	49,000	.001600	.000033	.....	.....	
12,500	50,000	.001633	.000033	.....	.....	
12,750	51,000	.001667	.000034	.....	.....	
13,000	52,000	.001700	.000033	.....	.....	
13,250	53,000	.001767	.000067	.....	.....	
13,500	54,000	.001800	.000033	.....	.....	Elastic limit.
13,750	55,000	.012700	.010900	.....	.....	
14,000	56,000	.013333	.000633	.....	.....	
14,250	57,000	.014000	.000667	.....	.....	
14,500	58,000	.015167	.001167	.....	.....	
14,750	59,000	.016067	.000900	.....	.....	
21,370	85,480	.1333	.117233	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,480
Elastic limit per square inch of original section	do...	54,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.12, ″.43*, ″.15

TUBE.

No. 5204.

Marks, $\frac{4650\ B_1\ F_1}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001167	.000200	0.	.....	
10,000	40,000	.001300	.000133	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	Elastic limit.
10,750	43,000	.001467	.000100	.....	.....	
11,000	44,000	.003667	.002200	.....	.....	
11,250	45,000	.004667	.001000	.....	.....	
11,500	46,000	.005733	.001066	.....	.....	
11,750	47,000	.006567	.000834	.....	.....	
20,360	81,440	.1533	.146733	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	81,440
Elastic limit per square inch of original section	do...	42,000
Elongation per inch after rupture	inch..	.2400
Elongation per inch under strain at elastic limit	do...	.001367
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.25 from neck
Character of broken surface		silky
Elongation of inch sections		″.18, ″.29*, ″.26*

TUBE.

No. 5203.

Marks, $\frac{4659\ B_1\ F_1}{M\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001367	.000167	.000033	.000033	
10,250	41,000	.001400	.000033	.....	.....	
10,500	42,000	.001433	.000033	.....	.....	
10,750	43,000	.001500	.000067	.....	.....	
11,000	44,000	.001533	.000033	.....	.....	
11,250	45,000	.001567	.000034	.....	.....	Elastic limit.
11,500	46,000	.011300	.009733	.....	.....	
11,750	47,000	.012000	.000700	.....	.....	
12,000	48,000	.012933	.000933	.....	.....	
12,250	49,000	.013667	.000734	.....	.....	
12,500	50,000	.015100	.001433	.....	.....	
19,070	76,280	.1500	.1349	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	76,280
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2933
Elongation per inch under strain at elastic limit	do...	.001567
Reduction in diameter at point of rupture	do...	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		1".64 from neck
Character of broken surface		silky
Elongation of inch sections		".18, ".45*, ".25

JACKET.

No. 4934.

Marks, $\frac{4757\ B_1}{B\ T_2\ M}$
Diameter, ″.565.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001567	.000067	.....	.....	
12,000	48,000	.001600	.000033	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	
12,500	50,000	.001667	.000034	.....	.....	
12,750	51,000	.001700	.000033	.....	.....	
13,000	52,000	.001733	.000033	.....	.....	Elastic limit.
13,250	53,000	.010200	.008467	.....	.....	
13,560	54,000	.010767	.000567	.....	.....	
13,750	55,000	.011333	.000566	.....	.....	
14,000	56,000	.012267	.000934	.....	.....	
14,250	57,000	.013000	.000733	.....	.....	
22,610	90,440	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,440
Elastic limit per square inch of original section	do...	52,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do....	.001733
Reduction in diameter at point of rupture	do....	.145
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.3 from neck
Character of broken surface		silky
Elongation of inch sections		″.21, ″.32*, ″.14

JACKET.

No. 4933.

Marks, $\frac{4757\ B_1}{M\ T_2 M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001467	.000067	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001533	.000033	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	
12,000	48,000	.001633	.000066	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001800	.000067	.....	.....	Elastic limit.
13,250	53,000	.002000	.000200	.....	.....	
13,500	54,000	.006333	.004333	.....	.....	
13,750	55,000	.007000	.000667	.....	.....	
14,000	56,000	.008000	.001000	.....	.....	
14,250	57,000	.008667	.000667	.....	.....	
23,360	93,440	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	93,440
Elastic limit per square inch of original section	do...	52,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		".87 from neck
Character of broken surface		silky
Elongation of inch sections		".14, ".18, ".30*

JACKET.

No. 4942.

Marks, $\frac{4829\ B.}{B\ T.\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000633	.000300	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001333	.000033	0.	.....	
10,750	43,000	.001333	0.	.....	.....	
11,000	44,000	.001333	0.	.....	.....	
11,250	45,000	.001367	.000034	.....	.....	
11,500	46,000	.001400	.000033	.....	.....	
11,750	47,000	.001433	.000033	.....	.....	
12,000	48,000	.001467	.000034	.....	.....	
12,250	49,000	.001533	.000066	.....	.....	
12,500	50,000	.001600	.000067	.....	.....	
12,750	51,000	.001633	.000033	.....	.....	
13,000	52,000	.001667	.000034	.....	.....	
13,250	53,000	.001667	0.	.....	.....	
13,500	54,000	.001700	.000033	.....	.....	
13,750	55,000	.001733	.000033	.....	.....	Elastic limit.
14,000	56,000	.004667	.002934	.....	.....	
14,250	57,000	.005367	.000700	.....	.....	
14,500	58,000	.006333	.000966	.....	.....	
14,750	59,000	.007233	.000900	.....	.....	
15,000	60,000	.008033	.000800	.....	.....	
24,400	97,600	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	97,600
Elastic limit per square inch of original section	do...	55,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	001733
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.07 from neck
Character of broken surface		fine, silky, slightly granular
Elongation of inch sections		″.14, ″.19, ″.29*

JACKET.

No. 4941.

Marks, $\frac{4829\ B_1}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000267	.000167			
5,000	20,000	.000600	.000333			
7,500	30,000	.000933	.000333			
8,750	35,000	.001038	.000100	0.		
10,000	40,000	.001300	.000267			
10,500	42,000	.001333	.000033	0.		
10,750	43,000	.001333	0.			
11,000	44,000	.001400	.000067			
11,250	45,000	.001433	.000033			
11,500	46,000	.001500	.000067			
11,750	47,000	.001567	.000067			
12,000	48,000	.001600	.000033			
12,250	49,000	.001633	.000033			
12,500	50,000	.001667	.000034			
12,750	51,000	.001667	0.			Elastic limit.
13,000	52,000	.008000	.006333			
13,250	53,000	.008700	.000700			
13,500	54,000	.009700	.001000			
13,750	55,000	.010670	.000970			
14,000	56,000	.011700	.001030			
21,900	87,600					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,600
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.18 from neck
Character of broken surface		fine, silky
Elongation of inch sections		″.30*, ″.23, ″.15

JACKET.

No. 4967.

Marks, $\frac{4757\ B}{B\ T,\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001333	.000033	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001500	.000067	.....	.....	Elastic limit.
11,750	47,000	.001667	.000167	.....	.....	
12,000	48,000	.005567	.003900	.....	.....	
12,250	49,000	.006333	.000766	.....	.....	
12,500	50,000	.007667	.001334	.....	.....	
12,750	51,000	.008800	.000933	.....	.....	
21,320	85,280	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,280
Elastic limit per square inch of original section	do...	40,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do..	.001500
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.5 from neck
Character of broken surface		silky
Elongation of inch sections		″.18, ″.35*, ″.15

Chemical composition.

	Per cent.
Total carbon	0.484
Graphitic carbon	0.020
Combined carbon	0.464
Manganese	0.601
Silicon	0.140
Sulphur	0.030
Phosphorus	0.032
Copper	0.048

JACKET.

No. 4966.

Marks, $\frac{4757\ B_2}{M\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	0.	.....	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001433	.000066	0.	.....	
10,750	43,000	.001467	.000034	.....	.....	
11,000	44,000	.001533	.000066	.....	.....	Elastic limit
11,250	45,000	.001633	.000100	.....	.....	
11,500	46,000	.004333	.002700	.....	.....	
11,750	47,000	.006667	.002334	.....	.....	
12,000	48,000	.008333	.001666	.....	.....	
12,250	49,000	.009000	.000667	.....	.....	
20,710	82,840	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	82,840
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		″.75 from neck
Character of broken surface		silky
Elongation of inch sections		″.39*, ″.15, ″.14

JACKET.

No. 4991.

Marks, $\frac{4845\ B_1}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001100	.000100	0.	.....	
10,000	40,000	.001333	.000233	.....	.....	
10,500	42,000	.001367	.000034	0.	.....	
10,750	43,000	.001367	0.	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001567	.000100	.....	.....	
12,000	48,000	.001600	.000033	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	
12,500	50,000	.001667	.000034	.....	.....	
12,750	51,000	.001700	.000033	.....	.....	
13,000	52,000	.001733	.000033	.....	.....	Elastic limit.
13,250	53,000	.001933	.000200	.....	.....	
13,500	54,000	.003400	.001467	.....	.....	
13,750	55,000	.004600	.001200	.....	.....	
14,000	56,000	.005433	.000833	.....	.....	
14,250	57,000	.006400	.000967	.....	.....	
23,750	95,000	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,000
Elastic limit per square inch of original section	do...	52,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1″.38 from neck
Character of broken surface		granular, radiating from a silky spot at circumference
Elongation of inch sections		″.13, ″.30, ″.18

JACKET.

No. 4990.

Marks, $\frac{4845\ B,}{M\ T,\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001067	.000100	0.	.....	
10,000	40,000	.001300	.000233	.....	.....	
10,500	42,000	.001333	.000033	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001533	.000066	.....	.....	
12,000	48,000	.001600	.000067	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	
12,500	50,000	.001667	.000034	.....	.....	
12,750	51,000	.001667	0.	.....	.....	Elastic limit.
13,000	52,000	.002667	.001000	.....	.....	
13,250	53,000	.005167	.002500	.....	.....	
13,500	54,000	.006000	.000833	.....	.....	
13,750	55,000	.006933	.000933	.....	.....	
14,000	56,000	.007700	.000767	.....	.....	
23,250	93,000	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	93,000
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1".34 from neck
Character of broken surface		fine silky
Elongation of inch sections		".19,".31*,".11

JACKET No. 8.

No. 5015.

Marks, $\frac{10\ R_2\ J}{B\ T_1\ O}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001200	.000200	.000033	.000033	
10,000	40,000	.001367	.000167	.....	.....	
10,500	42,000	.001400	.000033	.000033	0.	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001600	.000067	.....	.....	
11,750	47,000	.001667	.000067	.....	.....	
12,000	48,000	.001667	0.	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	Elastic limit.
12,500	50,000	.001900	.000200	.....	.....	
12,750	51,000	.002833	.000933	.....	.....	
13,000	52,000	.005333	.002500	.....	.....	
13,250	53,000	.006333	.001000	.....	.....	
13,500	54,000	.007333	.001000	.....	.....	
22,460	89,840	.1333	.125967	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,840
Elastic limit per square inch of original section	do...	49,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1".08 from neck
Character of broken surface		silky, with a granular spot .".12 diameter
Elongation of inch sections		".38*, ".19, ".11

JACKET No. 8.

No. 5014.

Marks, $\frac{10\ R_8\ J}{M\ T_1\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001333	.000033	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001500	.000033	.....	.....	
12,000	48,000	.001567	.000067	.....	.....	
12,250	49,000	.001600	.000033	.....	.....	
12,500	50,000	.001633	.000033	.....	.....	
12,750	51,000	.001667	.000034	.....	.....	
13,000	52,000	.001700	.000033	.....	.....	
13,250	53,000	.001733	.000033	.....	.....	
13,500	54,000	.001767	.000034	.....	.....	
13,750	55,000	.001800	.000033	.....	.....	
14,000	56,000	.001833	.000033	.....	.....	
14,250	57,000	.001867	.000034	.....	.....	Elastic limit.
14,500	58,000	.001967	.000100	.....	.....	
14,750	59,000	.003667	.001700	.....	.....	
15,000	60,000	.005333	.001666	.....	.....	
15,250	61,000	.006667	.001334	.....	.....	
13,300	62,000	.008333	.001666	.....	.....	
24,180	96,720	.1267	.118367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	96,720
Elastic limit per square inch of original section	do...	57,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001867
Reduction in diameter at point of rupture	do...	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		at middle of stem
Character of broken surface		silky
Elongation of inch sections		″.12, ″.42*, ″.14

JACKET No. 9.

No. 5023.

Marks, $^{10\ R_2\ J}_{B\ T_1\ O}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load
1,250	5.000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
11,000	44,000	.001467	.000134	0.	.....	
11,250	45,000	.001533	.000066	.....	.....	
11,500	46,400	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001767	.000034	.....	.....	
13,250	53,000	.001767	0.	.....	.....	
13,500	54,000	.001800	.000033	.....	.....	
13,750	55,000	.001833	.000033	.....	.....	
14,000	56,000	.001867	.000034	.....	.....	
14,250	57,000	.001933	.000066	.....	.....	
14,500	58,000	.002000	.000067	.....	.....	Elastic limit.
14,750	59,000	.002667	.000667	.....	.....	
15,000	60,000	.004267	.001600	.....	.....	
15,250	61,000	.006000	.001733	.....	.....	
15,500	62,000	.007333	.001333	.....	.....	
15,750	63,000	.008333	.001000	.....	.....	
25,140	100,560	.1300	.121667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	100,560
Elastic limit per square inch of original section	do...	58,000
Elongation per inch after rupture	inch..	.1667
Elongation per inch under strain at elastic limit	do...	.002000
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		1".2 from neck
Character of broken surface		granular, containing a dull flaky section ".30 by ".08. Opened cracks in surface of stem.
Elongation of inch sections		".11, ".20*, ".19*

Chemical composition.

	Per cent.
Total carbon	0.581
Graphitic carbon	0.025
Combined carbon	0.556
Manganese	0.750
Silicon	0.233
Sulphur	0.038
Phosphorus	0.032
Copper	0.000

JACKET NO. 9.

No. 5024.

Marks, $\frac{10\ R,\ J}{M\ T,\ O}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
11,000	44,000	.001433	.000100	0.	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001567	.000067	.....	.....	
12,000	48,000	.001633	.000066	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001733	.000033	.....	.....	
13,000	52,000	.001767	.000034	.....	.....	Elastic limit.
13,250	53,000	.001867	.000100	.....	.....	
13,500	54,000	.006167	.004300	.....	.....	
13,750	55,000	.007333	.001166	.....	.....	
14,000	56,000	.008333	.001000	.....	.....	
14,250	57,000	.009333	.001000	.....	.....	
22,310	89,240	.1367	.127367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,240
Elastic limit per square inch of original section	do...	52,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″ from neck
Character of broken surface		silky
Elongation of inch sections		″.38*, ″.16, ″.11

Chemical composition.

	Per cent.
Total carbon	0.574
Graphitic carbon	0.023
Combined carbon	0.541
Manganese	0.748
Silicon	0.233
Sulphur	0.036
Phosphorus	0.028
Copper	0.000

JACKET.

No. 5026.

Marks, $\frac{5287\ B}{B\ T, M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	Elastic limit.
12,000	48,000	.010667	.000067	.....	.....	
12,250	49,000	.011667	.001000	.....	.....	
12,500	50,000	.012267	.000600	.....	.....	
12,750	51,000	.013167	.000900	.....	.....	
13,000	52,000	.014100	.000933	.....	.....	
20,710	82,840	.1633	.1492	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	82,840
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2633
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.6 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.18, ″.42*, ″.19

JACKET.

No. 5025.

Marks, $\frac{5287\ B_1}{M\ T_2 M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001467	.000067	.....	.....	
11,250	45,000	.001533	.000066	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	Elastic limit.
12,250	49,000	.003333	.001700	.....	.....	
12,500	50,000	.005700	.002367	.....	.....	
12,750	51,000	.006667	.000967	.....	.....	
13,000	52,000	.008000	.001333	.....	.....	
13,250	53,000	.009000	.001000	.....	.....	
21,920	87,680	.1600	.1510	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,680
Elastic limit per square inch of original section	do..	48,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		1". 4 from neck
Character of broken surface		fine silky
Elongation of inch sections		".15, ".35*, ".18

JACKET No. 12.

No. 5169.

Marks, $\frac{10\ R_{12}\ J}{B\ T_6\ I}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000267	.000167	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001067	.000134	0.	.....	
10,000	40,000	.001233	.000106	.....	.....	
10,500	42,000	.001300	.000067	0.	.....	
10,750	43,000	.001333	.000033	.....	.....	
11,000	44,000	.001400	.000067	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001533	.000066	.....	.....	Elastic limit.
12,000	48,000	.002333	.000800	.....	.....	
12,250	49,000	.004333	.001000	.....	.....	
12,500	50,000	.005667	.001334	.....	.....	
12,750	51,000	.006333	.000666	.....	.....	
13,000	52,000	.007333	.001000	.....	.....	
21,760	87,040	.1267	.119367	.....	.....	Tensile strength.

General summary.

Tensile strength, per square inch of original section	pounds..	87,040
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2133
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1". 4 from neck
Character of broken surface		silky
Elongation of inch sections		". 23, ". 31*, ". 10

JACKET No. 12.

No. 5170.

Marks, $\frac{10\ R_{12}\ J}{M\ T_8\ I}$
Diameter, $''.564$.
Sectional area, .25 square inch.
Gauged length, $3''$.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000300	.000167	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	
12,000	48,000	.001633	.000033	.....	.....	
12,250	49,000	.001667	.000034	.....	.....	
12,500	50,000	.001700	.000033	.....	.....	
12,750	51,000	.001767	.000067	.....	.....	Elastic limit.
13,000	52,000	.006167	.004400	.....	.....	
13,250	53,000	.007500	.001333	.....	.....	
13,500	54,000	.008667	.001167	.....	.....	
13,750	55,000	.009667	.001000	.....	.....	
14,000	56,000	.011000	.001333	.....	.....	
21,620	86,480	.1433	.1323	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,480
Elastic limit per squre inch of originalsection	do...	51,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		$''.1$. 7 from neck
Character of broken surface		silky
Elongation of inch sections		$''.15, ''.42^*, ''.13$

JACKET.

No. 5168.

Marks, $\frac{5350\ B}{B\ T,M}$
Diameter, ″.564.
Sectional area, 25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001333	.000200	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001533	.000033	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	
12,000	48,000	.001667	.000067	.....	.....	
12,250	49,000	.001700	.000033	.....	.....	
12,500	50,000	.001767	.000067	.....	.....	Elastic limit.
12,750	51,000	.002667	.000900	.....	.....	
13,000	52,000	.006000	.003333	.....	.....	
13,250	53,000	.007067	.001067	.....	.....	
13,500	54,000	.007767	.000700	.....	.....	
13,750	55,000	.008633	.000866	.....	.....	
22,560	90,240	.1433	.134667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,240
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.2 from neck
Character of broken surface		silky
Elongation of inch sections		″.29*, ″.25, ″.16

JACKET.

No. 5167.

Marks, $\frac{5350\ B}{M\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001567	.000067	.....	.....	
11,500	46,000	.001600	.000033	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001700	.000067	.....	.....	Elastic limit.
12,250	49,000	.004167	.002467	.....	.....	
12,500	5 ,000	.006667	.002500	.....	.....	
12,750	51,000	.007833	.001166	.....	.....	
13,000	52,000	.008667	.000834	.....	.....	
13,250	53,000	.009333	.000666	.....	.....	
22,140	88,560	.1433	.133967	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,560
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2267
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1". 2 from neck
Character of broken surface		silky
Elongation of inch sections		". 32*, ". 24, ". 12

JACKET No. 14.

No. 5176.

Marks, $\frac{10\ R_{\bullet}\ J}{B\ T_{\bullet}\ 1}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	
1,250	5,000	.000100	.000100	0.	.....	Initial load.
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001133	.000133	0.	.....	
10,000	40,000	.001333	.000200	.....	.....	
10,500	42,000	.001367	.000034	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001500	.000033	.....	.....	
11,750	47,000	.001567	.000067	.....	.....	Elastic limit.
12,000	48,000	.016000	.014433	.....	.....	
12,250	49,000	.016833	.000833	.....	.....	
12,500	50,000	.017333	.000500	.....	.....	
12,750	51,000	.017833	.000500	.....	.....	
13,000	52,000	.018500	.000667	.....	.....	
20,880	83,520	.1667	.1482	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	83,520
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2500
Elongation per inch under strain at elastic limit	do...	.001567
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.5 from neck
Character of broken surface		silky
Elongation of inch sections		″.14, ″.40*, ″.19

JACKET No. 14.

No. 5175.

Marks, $\frac{10\,R_{14}\,J}{M\,T_2\,I}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001600	.000067	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	Elastic limit.
12,000	48,000	.006600	.004967	.....	.....	
12,250	49,000	.007100	.000500	.....	.....	
12,500	50,000	.008300	.001200	.....	.....	
12,750	51,000	.009267	.000967	.....	.....	
13,000	52,000	.010333	.001066	.....	.....	
21,440	85,760	.1433	.132967	.....	.....	Tensile strennth.

General summary.

Tensile strength per square inch of original section	pounds..	85,760
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch.	.2333
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		at middle of stem
Character of broken surface		silky; opened cracks in surface of stem
Elongation of inch sections		".13, ".44*, ".13

JACKET No. 15.

No. 5180.

Marks, $^{10\ R_{15}\ J}_{B\ T_5\ I}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000933	.000300	.....	.....	
8,750	35,000	.001133	.000200	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001400	.000033	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001567	.000034	.....	.....	
12,000	48,000	.001600	.000033	.....	.....	
12,250	49,000	.001633	.000033	.....	.....	
12,500	50,000	.001667	.000034	.....	.....	
12,750	51,000	.001700	.000033	.....	.....	Elastic limit.
13,000	52,000	.002267	.000567	.....	.....	
13,250	53,000	.002833	.000566	.....	.....	
13,500	54,000	.004033	.001200	.....	.....	
13,750	55,000	.005100	.000967	.....	.....	
14,000	56,000	.006667	.001667	.....	.....	
22,220	92,880	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,880
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.001700
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		″.1 from neck
Character of broken surface		silky
Elongation of inch sections		″.08, ″.28, ″.29*

JACKET No. 15.

No. 5179.

Marks, $\frac{10\ R_{18}\ J}{M\ T_4\ I}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001333	.000033	0.	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001467	.000034	.....	.....	
11,750	47,000	.001533	.000066	.....	.....	
12,000	48,000	.001567	.000034	.....	.....	
12,250	49,000	.001600	.000033	.....	.....	
12,500	50,000	.001633	.000033	.....	.....	
12,750	51,000	.001667	.000034	.....	.....	Elastic limit.
13,000	52,000	.014367	.012700	.....	.....	
13,250	53,000	.015167	.000800	.....	.....	
13,500	54,000	.015833	.000666	.....	.....	
13,750	55,000	.016500	.000667	.....	.....	
14,000	56,000	.017667	.001167	.....	.....	
22,120	88,480	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,480
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.0667
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.024
Reduction in area after rupture, per cent of original section		8.4
Position of rupture		".3 from neck
Character of broken surface		granular
Elongation of inch sections		".06*, ".06, ".08

TABULATION OF TENSION SPECIMENS FROM 10-INCH STEEL B. L. RIFLES.

No. of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*P. ct.*	*P. ct.*		
4940	Tube	Middle	42,000	86,400	22.7	44.6	Fine silky	Breech end.
4939	do	do	49,000	91,600	16.7	47.2	do	Muzzle end.
4979	do	do	45,000	91,600	20.7	41.9	Granular, 50 per cent; silky, 50 per cent.	Breech end.
4978	do	do	52,000	90,000	22.3	44.6	Granular, 40 per cent; silky, 60 per cent.	Muzzle end.
4993	do	do	46,000	86,200	24.3	49.7	Fine silky	Breech end.
4992	do	do	47,000	88,800	23.0	49.7	do	Muzzle end.
5005	do	do	49,000	89,360	21.3	49.7	Silky	Breech end.
5004	do	do	47,000	86,560	22.3	49.7	do	Muzzle end.
5020	do	do	47,000	86,040	24.0	52.2	do	Breech end.
5019	do	do	46,000	85,960	23.0	49.7	do	Muzzle end.
5185	Tube No. 11	Inside	44,000	79,440	23.3	49.7	do	Breech end.
5186	do	do	42,000	80,760	18.3	27.6	Granular, 90 per cent; silky, 10 per cent.	Muzzle end.
5160	Tube No. 12	Outside	58,000	95,280	19.3	44.6	Silky	Breech end.
5161	do	do	40,000	78,880	24.0	36.4	Silky and fine granular.	Muzzle end.
5163	Tube No. 13	do	47,000	85,680	21.0	47.2	Silky	Breech end.
5164	do	do	46,000	80,080	22.7	52.2	do	Muzzle end.
5165	Tube No. 14	do	47,000	87,920	16.3	47.2	do	Breech end.
5166	do	do	48,000	80,120	22.3	49.7	do	Muzzle end.
5177	Tube No. 15	Inside	51,000	84,080	10.3	15.0	Granular, 80 per cent; dull flaky, 20 per cent.	Breech end.
5178	do	do	45,000	83,760	15.3	18.3	Granular, small flaky spot.	Muzzle end.
5194	Tube	Middle	53,000	90,200	20.3	39.2	Fine granular, 60 per cent silky.	Breech end.
5193	do	do	54,000	85,480	23.3	52.2	Silky	Muzzle end.
5204	do	do	42,000	81,440	24.0	52.2	do	Breech end.
5203	do	do	45,000	76,280	29.3	54.6	do	Muzzle end.
4934	Jacket	do	52,000	90,440	22.3	44.6	do	Breech end.
4933	do	do	52,000	93,440	20.7	41.9	do	Muzzle end.
4942	do	do	55,000	97,600	20.7	44.6	Fine silky, slightly granular.	Breech end.
4941	do	do	51,000	87,600	22.7	49.7	Fine silky	Muzzle.
4967	do	do	46,000	85,280	22.7	47.2	Silky	Breech.
4966	do	do	44,000	82,840	22.7	52.2	do	Muzzle end.
4991	do	do	52,000	95,000	20.3	39.2	Granular, silky spot	Breech end.
4990	do	do	51,000	93,000	20.3	49.7	Fine silky	Muzzle end.
5015	Jacket No. 8	Outside	49,000	89,840	22.7	49.7	Silky, granular spot	Breech end.
5014	do	do	57,000	96,720	22.7	54.6	Silky	Muzzle end.
5023	Jacket No. 9	do	58,000	100,560	16.7	33.5	Granular, and dull flaky.	Breech end.
5024	do	do	52,000	89,240	21.7	52.2	Silky	Muzzle end.
5026	Jacket	Middle	47,000	82,840	26.3	52.2	Fine silky	Breech end.
5025	do	do	48,000	87,680	22.7	54.6	do	Muzzle end.
5169	Jacket No. 12	Inside	47,000	87,040	21.3	49.7	Silky	Breech end.
5170	do	do	51,000	86,480	23.3	52.2	do	Muzzle end.
5168	Jacket	Middle	50,000	90,240	23.3	47.2	do	Breech end.
5167	do	do	48,000	88,560	22.7	49.7	do	Muzzle end.
5176	Jacket No. 14	Inside	47,000	83,520	25.0	49.7	do	Breech end.
5175	do	do	47,000	85,760	23.3	49.7	do	Muzzle end.
5180	Jacket No. 15	do	51,000	92,880	20.0	52.2	do	Breech end.
5179	do	do	51,000	88,480	6.7	8.4	Granular	Muzzle end.

12-INCH STEEL B. L. RIFLES.

SPECIMENS FROM TUBES AND JACKETS.

TUBE No. 15.

No. 4932.

Marks, $^{12}_{B}R_{15}T_{4}M$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	.....	.....	
2,500	10,000	.000267	.000167	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001100	.000167	.....	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,250	41,000	.001333	.000033	.....	.....	Elastic limit.
10,500	42,000	.001467	.000134	.....	.....	
10,750	43,000	.001700	.000233	.....	.....	
11,000	44,000	.002067	.000367	.....	.....	
11,250	45,000	.002600	.000533	.....	.....	
11,500	46,000	.003200	.000600	.....	.....	
21,970	87,880	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,880
Elastic limit per square inch of original section	do...	41,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do...	.001333
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.6 from neck
Character of broken surface		silky
Elongation of inch sections		″.14, ″.38*, ″.15

TUBE No. 15.

No. 4931.

Marks, $\frac{12\ R_{II}\ T}{M\ T_A\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001533	.000033	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	Elastic limit.
11,750	47,000	.001667	.000100	.....	.....	
12,000	48,000	.003667	.002000	.....	.....	
12,250	49,000	.004667	.001000	.....	.....	
12,500	50,000	.005733	.001066	.....	.....	
12,750	51,000	.006500	.000767	.....	.....	
22,610	90,440	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	90,440
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.001567
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1".5 from neck
Character of broken surface		silky
Elongation of inch sections		".13, ".37*, ".15

TUBE.

No. 4928.

Marks, $\frac{4686\ B,}{BT,M}$
Diameter, ″.565.
Sectional area .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000567	.000267	.....	.....	
7,500	30,000	.000900	.000333	.....	.....	
8,750	35,000	.001067	.000167	0.	.....	
10,000	40,000	.001233	.000166	0.	.....	
10,250	41,000	.001267	.000034	.....	.....	
10,500	42,000	.001300	.000033	.....	.....	
10,750	43,000	.001300	0.	.....	.....	
11,000	44,000	.001333	.000033	.....	.....	
11,250	45,000	.001367	.000034	.....	.....	
11,500	46,000	.001400	.000033	.....	.....	Elastic limit.
11,750	47,000	.001633	.000233	.....	.....	
12,000	48,000	.002267	.000634	.....	.....	
12,250	49,000	.002667	.000400	.....	.....	
12,500	50,000	.003667	.001000	.....	.....	
12,750	51,000	.004333	.000666	.....	.....	
22,480	89,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,920
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2200
Elongation per inch under strain at elastic limit	do...	.001400
Reduction in diameter at point of rupture	do...	.165
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.35 from neck
Character of broken surface		silky
Elongation of inch sections		″.20″.34*, ″.12

TUBE.

No. 4927.

Marks, $\frac{4686\ B}{M\ T,\ M}$
Diameter, ″.563.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001133	.000133	0.	.....	
10,000	40,000	.001333	.000200	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001400	0.	.....	.....	
11,000	44,000	.001433	.000033	.....	.....	
11,250	45,000	.001467	.000034	.....	.....	Elastic limit.
11,500	46,000	.001600	.000133	.....	.....	
11,750	47,000	.001867	.000267	.....	.....	
12,000	48,000	.003400	.001533	.....	.....	
12,250	49,000	.004100	.000700	.....	.....	
12,500	50,000	.005333	.001233	.....	.....	
21,870	87,480	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	87,480
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2533
Elongation per inch under strain at elastic limit	do...	.001467
Reduction in diameter at point of rupture	do...	.183
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		1″.06 from neck
Character of broken surface		silky
Elongation of inch sections		″.41*, ″.20, ″.16

TUBE.

No. 5013.

Marks, $\frac{5141\ B_1}{B\ T_2\ M}$
Diameter, ".564.
Sectional area, 25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001300	.000200	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001367	.000034	.....	.....	
10,750	43,000	.001367	0.	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001533	.000100	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	
12,000	48,000	.001667	.000067	.....	.....	
12,250	49,000	.001733	.000066	.....	.....	Elastic limit.
12,500	50,000	.002267	.000534	.....	.....	
12,750	51,000	.002667	.000400	.....	.....	
13,000	52,000	.003633	.000966	.....	.....	
13,250	53,000	.004333	.000700	.....	.....	
13,500	54,000	.005333	.001000	.....	.....	
23,750	95,000	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength **per square inch of original section**	pounds..	95,000
Elastic **limit per square inch of original section**	do...	49,000
Elongation **per inch after rupture**	inch..	.2100
Elongation **per inch under strain at elastic limit**	do....	.001733
Reduction **in diameter at point of rupture**	do....	.144
Reduction **in area after rupture, per cent of original section**		44.6
Position of rupture		1".6 from neck
Character of broken surface		silky
Elongation of inch sections		".16, ".85*, ".12

TUBE.

No. 5012.

Marks, $\frac{5141\ B}{M\ T,\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001267	.000167	0.	.....	
10,250	41,000	.001300	.000033	.....	.....	
10,500	42,000	.001333	.000033	.....	.....	
10,750	43,000	.001367	.000034	.....	.....	
11,000	44,000	.001433	.000066	.....	.....	Elastic limit.
11,250	45,000	.003733	.002300	.....	.....	
11,500	46,000	.005000	.001267	.....	.....	
11,750	47,000	.006067	.001067	.....	.....	
12,000	48,000	.007000	.000933	.....	.....	
12,250	49,000	.007667	.000667	.....	.....	
21,480	85,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,920
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.001433
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1".5 from neck
Character of broken surface		silky
Elongation of inch sections		".17, ".39*, ".13

TUBE.

No. 5151.

Marks, $\frac{4911\ B_1}{B\ T_2\ M}$
Diameter, '.564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001333	.000200	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	Elastic limit.
11,250	45,000	.002667	.001200	.....	.....	
11,500	46,000	.005000	.002333	.....	.....	
11,750	47,000	.006000	.001000	.....	.....	
12,000	48,000	.007000	.001000	.....	.....	
12,250	49,000	.007833	.000833	.....	.....	
21,340	85,360	.1400	.132167	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,360
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do...	.001467
Reduction in diameter at point of rupture	.do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1".3 from neck
Character of broken surface		granular, 60 per cent, silky serrated, 40 per cent
Elongation of inch sections		".27*, ".25*, ".15

TUBE.

No. 5150.

Marks, $\frac{4911\ B}{M\ T, M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001333	.000200	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001467	.000067	.....	.....	Elastic limit.
11,000	44,000	.001667	.000200	.....	.....	
11,250	45,000	.002167	.000500	.....	.....	
11,500	46,000	.003667	.001500	.....	.....	
11,750	47,000	.004333	.000666	.....	.....	
12,000	48,000	.005767	.001434	.....	.....	
21,590	86,360	.1467	.140933	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	86,360
Elastic limit per square inch of original section	do...	43,000
Elongation per inch after rupture	inch..	.2400
Elongation per inch under strain at elastic limit	do...	.001467
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.5 from neck
Character of broken surface		silky
Elongation of inch sections		″.16, .37*, ″.19

TUBE.

No. 5199.

Marks, $\frac{5103\ B_2}{B\ T_2\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	Elastic limit.
11,750	47,000	.001767	.000200	.....	.....	
12,000	48,000	.002000	.000233	.....	.....	
12,250	49,000	.002667	.000667	.....	.....	
12,500	50,000	.003333	.000666	.....	.....	
12,750	51,000	.004000	.000667	.....	.....	
23,170	92,680	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,680
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do...	.001567
Reduction in diameter at point of rupture	do...	.135
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		".88 from neck
Character of broken surface		silky
Elongation of inch sections		".12, ".20, ".35*

TUBE.

No. 5198.

Marks, $\frac{5103\ B}{M\ T,\ M}$
Diameter, ".565.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	.....	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,000	.001333	.000166	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001533	.000066	.....	.....	
11,500	46,000	.001600	.000067	.....	.....	
11,750	47,000	.001667	.000067	.....	.....	Elastic limit.
12,000	48,000	.006000	.004333	.....	.....	
12,250	49,000	.006400	.000400	.....	.....	
12,500	50,000	.006867	.000467	.....	.....	
12,750	51,000	.007667	.000800	.....	.....	
13,000	52,000	.008667	.001000	.....	.....	
22,180	88,720	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	88,720
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2067
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.145
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		".2 from neck
Character of broken surface		silky
Elongation of inch sections		".11, ".22, ".29

JACKET.

No. 5007.

Marks, $\frac{4868\ B}{BT,M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001300	.000167	.....	.....	
10,500	42,000	.001367	.000067	0.	.....	
10,750	43,000	.001367	0.	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	
11,250	45,000	.001433	.000033	.....	.....	
11,500	46,000	.001500	.000067	.....	.....	
11,750	47,000	.001567	.000067	.....	.....	Elastic limit.
12,000	48,000	.001667	.000100	.....	.....	
12,250	49,000	.001833	.000166	.....	.....	
12,500	50,000	.004333	.002500	.....	.....	
12,750	51,000	.005000	.000667	.....	.....	
13,000	52,000	.005667	.000667	.....	.....	
23,790	95,160	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,160
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.001567
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1".6 from neck
Character of broken surface		silky, 10 per cent granular
Elongation of inch sections		".15, ".33+, ".12

JACKET

No. 5006.

Marks, $\frac{1868\ B_1}{M\ T,\ M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001167	.000167	0.	.....	
10,000	40,006	.001333	.000166	.....	.....	
10,500	42,000	.001400	.000067	0.	.....	
10,750	43.000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001500	.000033	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	
11,750	47,000	.001600	.000033	.....	.....	Elastic limit.
12,000	48,000	.002000	.000400	.....	.....	
12,250	49,000	.003333	.001333	.....	.....	
12,500	50,000	.005000	.001667	.....	.....	
12,750	51,000	.006000	.001000	.....	.....	
13,000	52,000	.006667	.000667	.....	.....	
23,180	92,720	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,720
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.001600
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		".6 from neck
Character of broken surface		silky, 50 per cent of surface interspersed with fine granulation
Elongation of inch sections		".14, ".17, ".32*

JACKET.

No. 5159.

Marks, $\frac{5122\ B_2}{B\ T_2\ M}$
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000600	.000300	.....	.....	
7,500	30,000	.000933	.000333	.....	.....	
8,750	35,000	.001100	.000167	0.	.....	
10,000	40,000	.001300	.000200	.....	.....	
10,500	42,000	.001333	.000033	0.	.....	Elastic limit.
10,750	43,000	.003333	.002000	.....	.....	
11,000	44,000	.005333	.002000	.....	.....	
11,250	45,000	.006833	.001500	.....	.....	
11,500	46,000	.007667	.000834	.....	.....	
11,750	47,000	.008667	.001000	.....	.....	
21,150	84,600	.1533	.144633	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,600
Elastic limit per square inch of original section	do...	42,000
Elongation per inch after rupture	inch..	.2433
Elongation per inch under strain at elastic limit	do...	.001333
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1″.5 from neck
Character of broken surface		silky
Elongation of inch sections		″.20, ″.40*, ″.13

JACKET.

No. 5158.

Marks, $\frac{5122\ B}{M\ T}$, $\frac{}{M}$
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000267	.000167	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000967	.000367	.....	.....	
8,750	35,000	.001133	.000166	0.	.....	
10,000	40,000	.001267	.000134	.....	.....	
10,500	42,000	.001333	.000066	.....	.....	
10,750	43,000	.001333	0.	.....	.....	
11,000	44,000	.001367	.000034	.....	.....	
11,250	45,000	.001400	.000033	.....	.....	
11,500	46,000	.001400	0.	.....	.....	
11,750	47,000	.001433	.000033	.....	.....	Elastic limit.
12,000	48,000	.002667	.001234	.....	.....	
12,250	49,000	.003833	.001166	.....	.....	
12,500	50,000	.005267	.001434	.....	.....	
12,750	51,000	.006000	.001733	.....	.....	
13,000	52,000	.007333	.001333	.....	.....	
23,080	92,320	.1500	.142667	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	92,320
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2133
Elongation per inch under strain at elastic limit	do...	.001433
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		".8 from neck
Character of broken surface		silky
Elongation of inch sections		".14, ".17, ".35*

TABULATION OF TENSION SPECIMENS FROM 12-INCH STEEL B. L. RIFLES.

Number of test.	Position in gun.	Location of specimens.	Elastic limit per square inch.	Tensile strength per square inch.	Elongation.	Contraction of area.	Appearance of fracture.	Remarks.
			Pounds.	*Pounds.*	*Per. ct.*	*Per. ct.*		
4932	Tube No. 15.	Middle .	41,000	87,880	22.3	44.6	Silky	Breech end.
4931	.....do	.....do ...	46,000	90,440	21.7	44.6	.....do	Muzzle end.
9228	Tube	.....do ...	46,000	89,920	22.0	49.7	.....do	Breech end.
4927	.....do	.....do ...	45,000	87,480	25.3	54.6	.....do	Muzzle end.
5013	.....do	.....do ...	49,000	95,000	21.0	44.6	.....do	Breech end.
5012	.....do	.....do ...	44,000	85,920	23.0	49.7	.....do	Muzzle end.
5151	.....do	.....do ...	44,000	85,360	22.3	41.9	Granular 60 per cent; silky, serrated, 40 per cent.	Breech end.
5150	.....do	.....do ...	43,000	86,360	24.0	49.7	Silky	Muzzle end.
5199	.....do	.....do ...	46,000	92,680	22.3	41.9	.....do	Breech end.
5198	.....do	.....do ...	47,000	88,720	20.7	44.6	.....do	Muzzle end.
5007	Jacket.....	Middle .	47,000	95,160	20.0	44.6	Silky, 10 per cent granular.	Breech end.
5006	.....do	.....do ...	47,000	92,720	21.0	47.2	Silky and fine granular.	Muzzle end.
5159	.....do	.....do ...	42,000	84,600	24.3	52.2	Silky	Breech end.
5158	.....do	.....do ...	47,000	92,920	21.9	44.6	.....do	Muzzle end.

12-INCH B. L. RIFLED MORTARS.

SPECIMENS FROM CAST-IRON BODIES.

Body No. 31.

No. 4945.

Marks, $\frac{12\,M\,R_2\,T\,R_2}{B\,T_1}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0.	.....	
6,000	6,000	.000250	.000050	.....	.....	
7,000	7,000	.000300	.000050	.....	.....	
8,000	8,000	.000355	.000055	.....	.....	
9,000	9,000	.000410	.000055	.....	.....	
10,000	10,000	.000470	.000060	.000010	.000010	
11,000	11,000	.000520	.000050	.....	.....	
12,000	12,000	.000575	.000055	.000025	.000015	
13,000	13,000	.000645	.000070	.....	.....	
14,000	14,000	.000705	.000060	.000050	.000025	
15,000	15,000	.000785	.000080	.....	.....	
16,000	16,000	.000850	.000065	.000070	.000020	
17,000	17,000	.000940	.000090	.....	.....	
18,000	18,000	.001040	.000100	.000105	.000035	
19,000	19,000	.001115	.000075	.....	.....	
20,000	20,000	.001225	.000110	.000195	.000090	
21,000	21,000	.001355	.000130	.....	.....	
22,000	22,000	.001500	.000145	.000305	.000110	
23,000	23,000	.001660	.000160	.....	.....	
24,000	24,000	.001825	.000165	.000500	.000195	
25,000	25,000	.002070	.000145	.000675	.000175	
26,470	26,470	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance, granular; coarse spangles near circumference on one side of specimen.

No. 4946.

Marks, $\frac{12\,M\,R_{11}\,T\,R_1}{M\,T_1}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050			
3,000	3,000	.000100	.000050			
4,000	4,000	.000150	.000050			
5,000	5,000	.000200	.000050	0.		
6,000	6,000	.000250	.000050			
7,000	7,000	.000295	.000045			
8,000	8,000	.000345	.000050			
9,000	9,000	.000400	.000055			
10,000	10,000	.000450	.000050	.000010	.000010	
11,000	11,000	.000505	.000055			
12,000	12,000	.000555	.000050	.000035	.000025	
13,000	13,000	.000610	.000055			
14,000	14,000	.000670	.000060	.000045	.000010	
15,000	15,000	.000735	.000065			
16,000	16,000	.000800	.000065	.000050	.000005	
17,000	17,000	.000855	.000055			
18,000	18,000	.000935	.000080	.000065	.000015	
19,000	19,000	.001000	.000065			
20,000	20,000	.001070	.000070	.000105	.000040	
21,000	21,000	.001160	.000090			
22,000	22,000	.001250	.000090	.000155	.000050	
23,000	23,000	.001350	.000100			
24,000	24,000	.001455	.000105	.000250	.000095	
25,000	25,000	.001590	.000135	.000300	.000050	
33,180	33,180					Tensile strength.

Fractured 2″.5 from neck. Appearance, granular.

No. 1136.

Marks, $^{12\ M\ R_4\ T\ R_2}_{B\ T_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00006	.....	.....	
4,000	4,000	.00016	.00004	.....	.....	
5,000	5,000	.00022	.00006	.00002	.00002	
6,000	6,000	.00028	.00006	.....	.....	
7,000	7,000	.00032	.00004	.....	.....	
8,000	8,000	.00036	.00004	.....	.....	
9,000	9,000	.00042	.00006	.....	.....	
10,000	10,000	.00048	.00006	.00004	.00002	
11,000	11,000	.00054	.00006	.....	.....	
12,000	12,000	.00060	.00006	.....	.....	
13,000	13,000	.00066	.00006	.....	.....	
14,000	14,000	.00072	.00006	.....	.....	
15,000	15,000	.00078	.00006	.00008	.00004	
16,000	16,000	.00082	.00004	.....	.....	
17,000	17,000	.00092	.00010	.....	.....	
18,000	18,000	.00096	.00004	.....	.....	
19,000	19,000	.00104	.00008	.....	.....	
20,000	20,000	.00108	.00004	.00014	.00006	
21,000	21,000	.00116	.00008	.....	.....	
22,000	22,000	.00124	.00008	.....	.....	
23,000	23,000	.00134	.00010	.....	.....	
24,000	24,000	.00140	.00006	.....	.....	
25,000	25,000	.00148	.00008	.00026	.00012	
26,000	26,000	.00158	.00010	.....	.....	
27,000	27,000	.00166	.00008	.....	.....	
28,000	28,000	.00180	.00014	.....	.....	
29,000	29,000	.00192	.00012	.....	.....	
30,000	30,000	.00206	.00014	.00058	.00032	
31,000	31,000	.00220	.00014	.....	.....	
32,000	32,000	.00236	.00016	.....	.....	
33,000	33,000	.00260	.00024	.....	.....	
34,000	34,000	.00284	.00024	.....	.....	
35,000	35,000	.00314	.00030	.00134	.00076	
36,000	36,000	.00350	.00036	.....	.....	
37,000	37,000	.00386	.00036	.....	.....	
38,000	38,000	.00428	.00042	.....	.....	
39,000	39,000	.00478	.00050	.....	.....	
40,000	40,000	.00528	.00050	.00320	.00186	
41,000	41,000	.00586	.00058	.....	.....	
42,000	42,000	.00624	.00038	.....	.....	
43,000	43,000	.00680	.00056	.....	.....	
44,000	44,000	.00756	.00076	.....	.....	
45,000	45,000	.00828	.00072	.00580	.00260	
46,000	46,000	.00884	.00056	.....	.....	
47,000	47,000	.00960	.00076	.....	.....	
48,000	48,000	.01080	.00120	.....	.....	
49,000	49,000	.01200	.00120	.....	.....	
50,000	50,000	.01304	.00104	.01022	.00442	
59,880	59,880	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected downward.

No. 1137.

Marks, $^{12\ M\ R_{11}\ T\ R_2}_{B\ R_{10}}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006			
3,000	3,000	.00012	.00006			
4,000	4,000	.00018	.00006			
5,000	5,000	.00022	.00004	0.		
6,000	6,000	.00026	.00004			
7,000	7,000	.00032	.00006			
8,000	8,000	.00038	.00006			
9,000	9,000	.00042	.00004			
10,000	10,000	.00046	.00004	.00002	.00002	
11,000	11,000	.00052	.00006			
12,000	12,000	.00058	.00006			
13,000	13,000	.00062	.00004			
14,000	14,000	.00066	.00004			
15,000	15,000	.00074	.00008	.00006	.00004	
16,000	16,000	.00078	.00004			
17,000	17,000	.00084	.00006			
18,000	18,000	.00090	.00006			
19,000	19,000	.00096	.00006			
20,000	20,000	.00100	.00004	.00012	.00006	
21,000	21,000	.00106	.00006			
22,000	22,000	.00114	.00008			
23,000	23,000	.00120	.00006			
24,000	24,000	.00128	.00008			
25,000	25,000	.00138	.00010	.00020	.00008	
26,000	26,000	.00146	.00008			
27,000	27,000	.00154	.00008			
28,000	28,000	.00162	.00008			
29,000	29,000	.00174	.00012			
30,000	30,000	.00184	.00010	.00042	.00020	
31,000	31,000	.00200	.00016			
32,000	32,000	.00212	.00012			
33,000	33,000	.00232	.00020			
34,000	34,000	.00252	.00020			
35,000	35,000	.00278	.00026	.00114	.00072	
36,000	36,000	.00304	.00026			
37,000	37,000	.00340	.00036			
38,000	38,000	.00376	.00036			
39,000	39,000	.00420	.00044			
40,000	40,000	.00464	.00044	.00268	.00154	
41,000	41,000	.00500	.00036			
42,000	42,000	.00550	.00050			
43,000	43,000	.00600	.00050			
44,000	44,000	.00640	.00040			
45,000	45,000	.00696	.00056	.00476	.00208	
46,000	46,000	.00742	.00046			
47,000	47,000	.00796	.00054			
48,000	48,000	.00840	.00044			
49,000	49,000	.00888	.00048			
50,000	50,000	.00918	.00030	.00670	.00194	
60,580	60,580					Ultimate strength.

Failed by triple flexure. Deflected upward.

No. 1138.

Marks, $^{12}\,\mathrm{M}\,\mathrm{R}_{21}\,\mathrm{T}\,\mathrm{R}_{1}$ / $\mathrm{M}\,\mathrm{T}_{2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00006	.....	.....	
4,000	4,000	.00016	.00004	.....	.....	
5,000	5,000	.00020	.00004	0.	.....	
6,000	6,000	.00024	.00004	.....	.....	
7,000	7,000	.00030	.00006	.....	.....	
8,000	8,000	.00036	.00006	.....	.....	
9,000	9,000	.00040	.00004	.....	.....	
10,000	10,000	.00044	.00004	.00002	.00002	
11,000	11,000	.00050	.00006	.....	.....	
12,000	12,000	.00056	.00006	.....	.....	
13,000	13,000	.00062	.00006	.....	.....	
14,000	14,000	.00068	.00006	.....	.....	
15,000	15,000	.00074	.00006	.00004	.00002	
16,000	16,000	.00080	.00006	.....	.....	
17,000	17,000	.00086	.00006	.....	.....	
18,000	18,000	.00092	.00006	.....	.....	
19,000	19,000	.00098	.00006	.....	.....	
20,000	20,000	.00102	.00004	.00008	.00004	
21,000	21,000	.00108	.00006	.....	.....	
22,000	22,000	.00114	.00006	.....	.....	
23,000	23,000	.00120	.00006	.....	.....	
24,000	24,000	.00126	.00006	.....	.....	
25,000	25,000	.00132	.00006	.00014	.00006	
26,000	26,000	.00138	.00006	.....	.....	
27,000	27,000	.00146	.00008	.....	.....	
28,000	28,000	.00152	.00006	.....	.....	
29,000	29,000	.00158	.00006	.....	.....	
30,000	30,000	.00164	.00006	.00020	.00006	
31,000	31,000	.00174	.00010	.....	.....	
32,000	32,000	.00180	.00006	.....	.....	
33,000	33,000	.00188	.00008	.....	.....	
34,000	34,000	.00198	.00010	.....	.....	
35,000	35,000	.00206	.00008	.00038	.00018	
36,000	36,000	.00218	.00012	.....	.....	
37,000	37,000	.00228	.00010	.....	.....	
38,000	38,000	.00240	.00012	.....	.....	
39,000	39,000	.00256	.00016	.....	.....	
40,000	40,000	.00266	.00010	.00068	.00030	
41,000	41,000	.00288	.00022	.....	.....	
42,000	42,000	.00304	.00016	.....	.....	
43,000	43,000	.00322	.00018	.....	.....	
44,000	44,000	.00350	.00028	.....	.....	
45,000	45,000	.00376	.00026	.00144	.00076	
46,000	46,000	.00406	.00030	.....	.....	
47,000	47,000	.00434	.00028	.....	.....	
48,000	48,000	.00462	.00028	.....	.....	
49,000	49,000	.00500	.00038	.....	.....	
50,000	50,000	.00532	.00032	.00280	.00136	
66,180	66,180	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected horizontally.

BODY NO. 33.

No. 4929.

Marks, $^{12\,M\,R_B\,T\,R_2}_{B\,T,}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000145	.000045	.....	.....	
5,000	5,000	.000195	.000050	0.	.....	
6,000	6,000	.000245	.000050	.....	.....	
7,000	7,000	.000295	.000050	.....	.....	
8,000	8,000	.000345	.000050	.....	.....	
9,000	9,000	.000400	.000055	.....	.....	
10,000	10,000	.000450	.000050	.000005	.000005	
11,000	11,000	.000505	.000055	.....	.....	
12,000	12,000	.000560	.000055	.000035	.000030	
13,000	13,000	.000620	.000060	.....	.....	
14,000	14,000	.000680	.000060	.000050	.000015	
15,000	15,000	.000740	.000060	.....	.....	
16,000	16,000	.000805	.000065	.000080	.000010	
17,000	17,000	.000875	.000070	.....	.....	
18,000	18,000	.000955	.000080	.000100	.000040	
19,000	19,000	.001030	.000075	.....	.....	
20,000	20,000	.001115	.000085	.000155	.000055	
21,000	21,000	.001230	.000115	.....	.....	
22,000	22,000	.001335	.000105	.000245	.000090	
23,000	23,000	.001455	.000120	.....	.....	
24,000	24,000	.001605	.000150	.000195	.000150	
25,000	25,000	.001795	.000190	.000500	.000105	
28,330	28,330	.....	.....	.....	.....	Tensile strength.

Fractured 3″.7 from neck. Appearance, granular.

No. 4930.

Marks, $^{12\ M\ R_{II}\ T\ R_{I}}_{M\ T}$.
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000045	.000045	.....	.....	
3,000	3,000	.000090	.000045	.....	.....	
4,000	4,000	.000145	.000055	.....	.....	
5,000	5,000	.000195	.000050	0.	.....	
6,000	6,000	.000245	.000050	.....	.....	
7,000	7,000	.000295	.000050	.....	.....	
8,000	8,000	.000345	.000050	.....	.....	
9,000	9,000	.000395	.000050	.....	.....	
10,000	10,000	.000445	.000050	.000005	.000005	
11,000	11,000	.000500	.000055	.....	.....	
12,000	12,000	.000555	.000055	.000015	.000010	
13,000	13,000	.000615	.000060	.....	.....	
14,000	14,000	.000690	.000075	.000015	.000030	
15,000	15,000	.000750	.000060	.....	.....	
16,000	16,000	.000810	.000060	.000055	.000010	
17,000	17,000	.000895	.000085	.....	.....	
18,000	18,000	.000960	.000065	.000095	.000040	
19,000	19,000	.001050	.000090	.....	.....	
20,000	20,000	.001145	.000095	.000145	.000050	
21,000	21,000	.001225	.000080	.....	.....	
22,000	22,000	.001325	.000100	.000205	.000060	
23,000	23,000	.001450	.000125	.....	.....	
24,000	24,000	.001560	.000110	.000310	.000105	
25,000	25,000	.001740	.000180	.000405	.000095	
31,210	31,210	.....	.....	.....	.....	Tensile strength.

Fractured 11″.5 from neck. Appearance, granular.

No. 1127.

Marks, 12 M R_{13} T R_4 B T_2
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads. Total.	*Applied loads.* Per square inch.	Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	....	....	
3,000	3,000	.00010	.00006	....	....	
4,000	4,000	.00014	.00004	....	....	
5,000	5,000	.00018	.00004	0.	....	
6,000	6,000	.00022	.00004	....	....	
7,000	7,000	.00026	.00004	....	....	
8,000	8,000	.00032	.00006	....	....	
9,000	9,000	.00036	.00004	....	....	
10,000	10,000	.00040	.00004	.00002	.00002	
11,000	11,000	.00046	.00006	....	....	
12,000	12,000	.00052	.00006	....	....	
13,000	13,000	.00056	.00004	....	....	
14,000	14,000	.00060	.00004	....	....	
15,000	15,000	.00064	.00004	.00004	.00002	
16,000	16,000	.00070	.00006	....	....	
17,000	17,000	.00076	.00006	....	....	
18,000	18,000	.00082	.00006	....	....	
19,000	19,000	.00088	.00006	....	....	
20,000	20,000	.00096	.00008	.00008	.00004	
21,000	21,000	.00102	.00006	....	....	
22,000	22,000	.00108	.00006	....	....	
23,000	23,000	.00114	.00006	....	....	
24,000	24,000	.00120	.00006	....	....	
25,000	25,000	.00128	.00008	.00018	.00010	
26,000	26,000	.00136	.00008	....	....	
27,000	27,000	.00144	.00008	....	....	
28,000	28,000	.00154	.00010	....	....	
29,000	29,000	.00164	.00010	....	....	
30,000	30,000	.00178	.00014	.00042	.00024	
31,000	31,000	.00194	.00016	....	....	
32,000	32,000	.00210	.00016	....	....	
33,000	33,000	.00230	.00020	....	....	
34,000	34,000	.00256	.00026	....	....	
35,000	35,000	.00276	.00020	.00116	.00074	
36,000	36,000	.00308	.00032	....	....	
37,000	37,000	.00344	.00036	....	....	
38,000	38,000	.00388	.00044	....	....	
39,000	39,000	.00426	.00038	....	....	
40,000	40,000	.00460	.00034	.00270	.00160	
41,000	41,000	.00504	.00044	....	....	
42,000	42,000	.00550	.00046	....	....	
43,000	43,000	.00610	.00060	....	....	
44,000	44,000	.00660	.00050	....	....	
45,000	45,000	.00700	.00040	.00184	.00208	
46,000	46,000	.00740	.00040	....	....	
47,000	47,000	.00796	.00056	....	....	
48,000	48,000	.00836	.00040	....	....	
49,000	49,000	.00874	.00038	....	....	
50,000	50,000	.00912	.00038	.00676	.00192	
61,000	61,000	....	....	....	....	Ultimate strength.

Failed by triple flexure. Deflected upward and sidewise.

No. 1128.

Marks, $\frac{12\ M\ R_{22}\ T\ R_2}{B\ R_{10}}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00018	.00004	0.	.....	
6,000	6,000	.00024	.00006	.....	.....	
7,000	7,000	.00028	.00004	.....	.....	
8,000	8,000	.00032	.00004	.....	.....	
9,000	9,000	.00036	.00004	.....	.....	
10,000	10,000	.00040	.00004	.00000	.00000	
11,000	11,000	.00044	.00004	.....	.....	
12,000	12,000	.00048	.00004	.....	.....	
13,000	13,000	.00054	.00006	.....	.....	
14,000	14,000	.00058	.00004	.....	.....	
15,000	15,000	.00062	.00004	.00002	.00002	
16,000	16,000	.00068	.00006	.....	.....	
17,000	17,000	.00074	.00006	.....	.....	
18,000	18,000	.00080	.00006	.....	.....	
19,000	19,000	.00084	.00004	.....	.....	
20,000	20,000	.00090	.00006	.00006	.00004	
21,000	21,000	.00098	.00008	.....	.....	
22,000	22,000	.00104	.00006	.....	.....	
23,000	23,000	.00112	.00008	.....	.....	
24,000	24,000	.00118	.00006	.....	.....	
25,000	25,000	.00124	.00006	.00014	.00008	
26,000	26,000	.00130	.00006	.....	.....	
27,000	27,000	.00136	.00006	.....	.....	
28,000	28,000	.00144	.00008	.....	.....	
29,000	29,000	.00152	.00008	.....	.....	
30,000	30,000	.00160	.00008	.00034	.00020	
31,000	31,000	.00176	.00016	.....	.....	
32,000	32,000	.00194	.00018	.....	.....	
33,000	33,000	.00206	.00012	.....	.....	
34,000	34,000	.00226	.00020	.....	.....	
35,000	35,000	.00248	.00022	.00092	.00058	
36,000	36,000	.00276	.00028	.....	.....	
37,000	37,000	.00304	.00028	.....	.....	
38,000	38,000	.00340	.00036	.....	.....	
39,000	39,000	.00382	.00042	.....	.....	
40,000	40,000	.00428	.00046	.00240	.00148	
41,000	41,000	.00470	.00042	.....	.....	
42,000	42,000	.00518	.00048	.....	.....	
43,000	43,000	.00568	.00050	.....	.....	
44,000	44,000	.00620	.00052	.....	.....	
45,000	45,000	.00662	.00042	.00452	.00212	
46,000	46,000	.00720	.00058	.....	.....	
47,000	47,000	.00758	.00038	.....	.....	
48,000	48,000	.00800	.00042	.....	.....	
49,000	49,000	.00850	.00050	.....	.....	
50,000	50,000	.00890	.00040	.00656	.00204	
60,860	60,860	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected sidewise.

No. 1129.

Marks, $^{12\ M\ R_B\ T\ R,}_{M\ T_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00014	.00006	.....	.....	
5,000	5,000	.00018	.00004	0.	.....	
6,000	6,000	.00022	.00004	.....	.....	
7,000	7,000	.00026	.00004	.....	.....	
8,000	8,000	.00030	.00004	.....	.....	
9,000	9,000	.00036	.00006	.....	.....	
10,000	10,000	.00040	.00004	.00002	.00002	
11,000	11,000	.00046	.00006	.....	.....	
12,000	12,000	.00052	.00006	.....	.....	
13,000	13,000	.00056	.00004	.....	.....	
14,000	14,000	.00060	.00004	.....	.....	
15,000	15,000	.00064	.00004	.00004	.00002	
16,000	16,000	.00072	.00008	.....	.....	
17,000	17,000	.00076	.00004	.....	.....	
18,000	18,000	.00082	.00006	.....	.....	
19,000	19,000	.00086	.00004	.....	.....	
20,000	20,000	.00092	.00006	.00006	.00002	
21,000	21,000	.00098	.00006	.....	.....	
22,000	22,000	.00104	.00006	.....	.....	
23,000	23,000	.00110	.00006	.....	.....	
24,000	24,000	.00116	.00006	.....	.....	
25,000	25,000	.00122	.00006	.00014	.00008	
26,000	26,000	.00130	.00008	.....	.....	
27,000	27,000	.00136	.00006	.....	.....	
28,000	28,000	.00142	.00006	.....	.....	
29,000	29,000	.00148	.00006	.....	.....	
30,000	30,000	.00156	.00008	.00020	.00006	
31,000	31,000	.00164	.00008	.....	.....	
32,000	32,000	.00174	.00010	.....	.....	
33,000	33,000	.00182	.00008	.....	.....	
34,000	34,000	.00194	.00012	.....	.....	
35,000	35,000	.00204	.00010	.00044	.00024	
36,000	36,000	.00222	.00018	.....	.....	
37,000	37,000	.00238	.00016	.....	.....	
38,000	38,000	.00256	.00022	.....	.....	
39,000	39,000	.00278	.00022	.....	.....	
40,000	40,000	.00296	.00018	.00110	.00066	
41,000	41,000	.00326	.00030	.....	.....	
42,000	42,000	.00358	.00032	.....	.....	
43,000	43,000	.00390	.00032	.....	.....	
44,000	44,000	.00420	.00030	.....	.....	
45,000	45,000	.00456	.00036	.00242	.00132	
46,000	46,000	.00516	.00060	.....	.....	
47,000	47,000	.00544	.00028	.....	.....	
48,000	48,000	.00582	.00038	.....	.....	
49,000	49,000	.00620	.00038	.....	.....	
50,000	50,000	.00662	.00042	.00422	.00180	
64,100	64,100	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected upward.

Body No. 34.

No. 4935.

Marks, $\frac{12\,M\,R_{34}\,T\,R_2}{B\,T_1}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000105	.000055	.....	.....	
4,000	4,000	.000155	.000050	.....	.....	
5,000	5,000	.000205	.000050	0.	.....	
6,000	6,000	.000260	.000055	.....	.....	
7,000	7,000	.000320	.000060	.....	.....	
8,000	8,000	.000380	.000060	.....	.....	
9,000	9,000	.000440	.000060	.....	.....	
10,000	10,000	.000495	.000055	.000025	.000025	
11,000	11,000	.000545	.000050	.....	.....	
12,000	12,000	.000605	.000060	.000045	.000020	
13,000	13,000	.000685	.000080	.....	.....	
14,000	14,000	.000750	.000065	.000050	.000005	
15,000	15,000	.000830	.000080	.....	.....	
16,000	16,000	.000905	.000075	.000090	.000040	
17,000	17,000	.000995	.000090	.....	.....	
18,000	18,000	.001095	.000100	.000145	.000055	
19,000	19,000	.001195	.000100	.....	.....	
20,000	20,000	.001305	.000110	.000240	.000095	
21,000	21,000	.001445	.000140	.....	.....	
22,000	22,000	.001605	.000160	.000395	.000155	
23,000	23,000	.001800	.000195	.....	.....	
24,000	24,000	.002025	.000225	.000660	.000265	
25,000	25,000	.002295	.000270	.000850	.000190	
26,630	26,630	.....	.....	.....	.....	Tensile strength.

Fractured 8″.7 from neck. Appearance, medium fine granular, 70 per cent; coarse, with dark spangles, 30 per cent.

No. 4936.

Marks, $^{12\ M\ R_4\ T\ R_1}_{M\ T_1}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0.	.....	
6,000	6,000	.000250	.000050	.....	.....	
7,000	7,000	.000310	.000060	.....	.....	
8,000	8,000	.000365	.000055	.....	.....	
9,000	9,000	.000420	.000055	.....	.....	
10,000	10,000	.000480	.000060	.000025	.000025	
11,000	11,000	.000545	.000065	.....	.....	
12,000	12,000	.000600	.000055	.000040	.000015	
13,000	13,000	.000660	.000060	.....	.....	
14,000	14,000	.000735	.000075	.000050	.000010	
15,000	15,000	.000800	.000065	.....	.....	
16,000	16,000	.000895	.000095	.000090	.000040	
17,000	17,000	.000955	.000060	.....	.....	
18,000	18,000	.001055	.000100	.000125	.000035	
19,000	19,000	.001150	.000095	.....	.....	
20,000	20,000	.001255	.000105	.000200	.000075	
21,000	21,000	.001380	.000125	.....	.....	
22,000	22,000	.001500	.000120	.000300	.000100	
23,000	23,000	.001650	.000150	.....	.....	
24,000	24,000	.001805	.000155	.000460	.000160	
25,000	25,000	.002025	.000220	.000605	.000145	
29,450	29,450	.....	.....	.....	.....	Tensile strength.

Fractured 2″.7 from neck. Appearance, granular.

No. 1130.

Marks, $^{12}\,M\,R_{B}^{H}\,T\,R_{T_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00010	.00004	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00020	.00006	0.	.....	
6,000	6,000	.00026	.00006	.....	.....	
7,000	7,000	.00032	.00006	.....	.....	
8,000	8,000	.00036	.00004	.....	.....	
9,000	9,000	.00040	.00004	.....	.....	
10,000	10,000	.00046	.00006	.00002	.00002	
11,000	11,000	.00054	.00008	.....	.....	
12,000	12,000	.00060	.00006	.....	.....	
13,000	13,000	.00064	.00004	.....	.....	
14,000	14,000	.00070	.00006	.....	.....	
15,000	15,000	.00074	.00004	.00008	.00006	
16,000	16,000	.00080	.00006	.....	.....	
17,000	17,000	.00086	.00006	.....	.....	
18,000	18,000	.00092	.00006	.....	.....	
19,000	19,000	.00100	.00008	.....	.....	
20,000	20,000	.00106	.00006	.00016	.00008	
21,000	21,000	.00114	.00008	.....	.....	
22,000	22,000	.00120	.00006	.....	.....	
23,000	23,000	.00128	.00008	.....	.....	
24,000	24,000	.00138	.00010	.....	.....	
25,000	25,000	.00146	.00008	.00024	.00008	
26,000	26,000	.00154	.00008	.....	.....	
27,000	27,000	.00166	.00012	.....	.....	
28,000	28,000	.00178	.00012	.....	.....	
29,000	29,000	.00190	.00012	.....	.....	
30,000	30,000	.00200	.00010	.00056	.00032	
31,000	31,000	.00222	.00022	.....	.....	
32,000	32,000	.00238	.00016	.....	.....	
33,000	33,000	.00260	.00022	.....	.....	
34,000	34,000	.00284	.00024	.....	.....	
35,000	35,000	.00320	.00036	.00150	.00094	
36,000	36,000	.00350	.00030	.....	.....	
37,000	37,000	.00382	.00032	.....	.....	
38,000	38,000	.00424	.00042	.....	.....	
39,000	39,000	.00476	.00052	.....	.....	
40,000	40,000	.00526	.00050	.00322	.00172	
41,000	41,000	.00590	.00064	.....	.....	
42,000	42,000	.00650	.00060	.....	.....	
43,000	43,000	.00712	.00062	.....	.....	
44,000	44,000	.00770	.00058	.....	.....	
45,000	45,000	.00860	.00090	.00622	.00300	
46,000	46,000	.00936	.00076	.....	.....	
47,000	47,000	.01000	.00064	.....	.....	
48,000	48,000	.01080	.00080	.....	.....	
49,000	49,000	.01230	.00150	.....	.....	
50,000	50,000	.01344	.00114	.01060	.00438	
57,150	57,150	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected downward.

No. 1131.

Marks, $^{12\,M\,R_{11}\,T\,R_2}_{B\,R_{10}}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00010	.00004	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00018	.00004	0.	.....	
6,000	6,000	.00022	.00004	.....	.....	
7,000	7,000	.00026	.00004	.....	.....	
8,000	8,000	.00030	.00004	.....	.....	
9,000	9,000	.00034	.00004	.....	.....	
10,000	10,000	.00038	.00004	0.	.....	
11,000	11,000	.00042	.00004	.....	.....	
12,000	12,000	.00048	.00006	.....	.....	
13,000	13,000	.00054	.00006	.....	.....	
14,000	14,000	.00058	.00004	.....	.....	
15,000	15,000	.00062	.00004	.00008	.00008	
16,000	16,000	.00070	.00008	.....	.....	
17,000	17,000	.00074	.00004	.....	.....	
18,000	18,000	.00078	.00004	.....	.....	
19,000	19,000	.00084	.00006	.....	.....	
20,000	20,000	.00090	.00006	.00012	.00004	
21,000	21,000	.00098	.00008	.....	.....	
22,000	22,000	.00104	.00006	.....	.....	
23,000	23,000	.00110	.00006	.....	.....	
24,000	24,000	.00120	.00010	.....	.....	
25,000	25,000	.00126	.00006	.00016	.00004	
26,000	26,000	.00132	.00006	.....	.....	
27,000	27,000	.00138	.00006	.....	.....	
28,000	28,000	.00146	.00008	.....	.....	
29,000	29,000	.00158	.00012	.....	.....	
30,000	30,000	.00172	.00014	.00038	.00022	
31,000	31,000	.00182	.00010	.....	.....	
32,000	32,000	.00202	.00020	.....	.....	
33,000	33,000	.00220	.00018	.....	.....	
34,000	34,000	.00242	.00022	.....	.....	
35,000	35,000	.00264	.00022	.00102	.00064	
36,000	36,000	.00300	.00036	.....	.....	
37,000	37,000	.00328	.00028	.....	.....	
38,000	38,000	.00360	.00032	.....	.....	
39,000	39,000	.00400	.00040	.....	.....	
40,000	40,000	.00434	.00034	.00242	.00140	
41,000	41,000	.00480	.00046	.....	.....	
42,000	42,000	.00510	.00030	.....	.....	
43,000	43,000	.00540	.00030	.....	.....	
44,000	44,000	.00570	.00030	.....	.....	
45,000	45,000	.00588	.00018	.00378	.00136	
46,000	46,000	.00604	.00016	.....	.....	
47,000	47,000	.00618	.00014	.....	.....	
48,000	48,000	.00630	.00012	.....	.....	
49,000	49,000	.00640	.00010	.....	.....	
50,000	50,000	.00650	.00010	.00444	.00066	
52,900	52,900	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected upward.

No. 1132.

Marks, $\frac{12\ M\ R_4\ T\ R_1}{M\ T_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00012	.00004	.....	.....	
5,000	5,000	.00016	.00004	0.	.....	
6,000	6,000	.00020	.00004	.....	.....	
7,000	7,000	.00024	.00004	.....	.....	
8,000	8,000	.00028	.00004	.....	.....	
9,000	9,000	.00034	.00006	.....	.....	
10,000	10,000	.00040	.00006	.00002	.00002	
11,000	11,000	.00046	.00006	.....	.....	
12,000	12,000	.00054	.00008	.....	.....	
13,000	13,000	.00058	.00004	.....	.....	
14,000	14,000	.00062	.00004	.....	.....	
15,000	15,000	.00068	.00006	.00006	.00004	
16,000	16,000	.00074	.00006	.....	.....	
17,000	17,000	.00080	.00006	.....	.....	
18,000	18,000	.00086	.00006	.....	.....	
19,000	19,000	.00092	.00006	.....	.....	
20,000	20,000	.00098	.00006	.00010	.00004	
21,000	21,000	.00104	.00006	.....	.....	
22,000	22,000	.00110	.00006	.....	.....	
23,000	23,000	.00116	.00006	.....	.....	
24,000	24,000	.00122	.00006	.....	.....	
25,000	25,000	.00130	.00008	.00018	.00008	
26,000	26,000	.00138	.00008	.....	.....	
27,000	27,000	.00146	.00008	.....	.....	
28,000	28,000	.00154	.00008	.....	.....	
29,000	29,000	.00160	.00006	.....	.....	
30,000	30,000	.00170	.00010	.00030	.00012	
31,000	31,000	.00178	.00008	.....	.....	
32,000	32,000	.00188	.00010	.....	.....	
33,000	33,000	.00198	.00010	.....	.....	
34,000	34,000	.00210	.00012	.....	.....	
35,000	35,000	.00222	.00012	.00054	.00024	
36,000	36,000	.00238	.00016	.....	.....	
37,000	37,000	.00254	.00016	.....	.....	
38,000	38,000	.00274	.00020	.....	.....	
39,000	39,000	.00300	.00026	.....	.....	
40,000	40,000	.00320	.00020	.00122	.00068	
41,000	41,000	.00356	.00036	.....	.....	
42,000	42,000	.00384	.00028	.....	.....	
43,000	43,000	.00422	.00038	.....	.....	
44,000	44,000	.00456	.00034	.....	.....	
45,000	45,000	.00496	.00040	.00272	.00150	
46,000	46,000	.00546	.00050	.....	.....	
47,000	47,000	.00594	.00048	.....	.....	
48,000	48,000	.00640	.00046	.....	.....	
49,000	49,000	.00690	.00050	.....	.....	
50,000	50,000	.00728	.00038	.00478	.00206	
61,300	61,300	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected sidewise and upward.

BODY No. 37.

No. 4943.

Marks, $^{12\ M\ R}_{B\ T}\ T\ R_2$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000045	.000045			
3,000	3,000	.000095	.000050			
4,000	4,000	.000145	.000050			
5,000	5,000	.000195	.000050	0.		
6,000	6,000	.000240	.000045			
7,000	7,000	.000300	.000060			
8,000	8,000	.000350	.000050			
9,000	9,000	.000400	.000050			
10,000	10,000	.000450	.000050	0.		
11,000	11,000	.000510	.000060			
12,000	12,000	.000570	.000060	.000010	.000010	
13,000	13,000	.000660	.000090			
14,000	14,000	.000700	.000040	.000040	.000030	
15,000	15,000	.000765	.000065			
16,000	16,000	.000845	.000080	.000055	.000015	
17,000	17,000	.000910	.000065			
18,000	18,000	.001005	.000095	.000100	.000045	
19,000	19,000	.001100	.000095			
20,000	20,000	.001205	.000105	.000180	.000080	
21,000	21,000	.001350	.000145			
22,000	22,000	.001465	.000115	.000300	.000120	
23,000	23,000	.001610	.000145			
24,000	24,000	.001800	.000190	.000490	.000190	
25,000	25,000	.002100	.000300	.000695	.000205	
27,300	27,300	.....	.....	.....	.....	Tensile strength.

Fractured 1″.2 from neck. Appearance, granular, with coarse, dark spangles.

No. 4944.

Marks, $\frac{12\ M\ R_{II}\ T\ R_{I}}{M\ T_{I}}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000095	.000045	.....	.....	
4,000	4,000	.000145	.000050	.....	.....	
5,000	5,000	.000190	.000045	0.	.....	
6,000	6,000	.000245	.000055	.....	.....	
7,000	7,000	.000290	.000045	.....	.....	
8,000	8,000	.000340	.000050	.....	.....	
9,000	9,000	.000390	.000050	.....	.....	
10,000	10,000	.000440	.000050	.000005	.000005	
11,000	11,000	.000495	.000055	.....	.....	
12,000	12,000	.000545	.000050	.000025	.000020	
13,000	13,000	.000600	.000055	.....	.....	
14,000	14,000	.000655	.000055	.000045	.000020	
15,000	15,000	.000730	.000075	.....	.....	
16,000	16,000	.000790	.000060	.000055	.000010	
17,000	17,000	.000855	.000065	.....	.....	
18,000	18,000	.000945	.000090	.000085	.000030	
19,000	19,000	.001005	.000060	.....	.....	
20,000	20,000	.001100	.000095	.000120	.000035	
21,000	21,000	.001190	.000090	.....	.....	
22,000	22,000	.001260	.000070	.000195	.000075	
23,000	23,000	.001360	.000100	.....	.....	
24,000	24,000	.001485	.000125	.000280	.000085	
25,000	25,000	.001650	.000165	.000350	000070	
31,240	31,240	.....	.....	.....	.....	Tensile strength.

Fractured 2″.2 from neck. Appearance, uniform granular, mottled.

No. 1133.

Marks, $^{12\ M\ R_R\ T\ R_2}_{B\ T_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00006	.....	.....	
4,000	4,000	.00018	.00006	.....	.....	
5,000	5,000	.00022	.00004	.00002	.00002	
6,000	6,000	.00026	.00004	.....	.....	
7,000	7,000	.00032	.00006	.....	.....	
8,000	8,000	.00038	.00006	.....	.....	
9,000	9,000	.00042	.00004	.....	.....	
10,000	10,000	.00048	.00006	.00004	.00002	
11,000	11,000	.00054	.00006	.....	.....	
12,000	12,000	.00060	.00006	.....	.....	
13,000	13,000	.00064	.00004	.....	.....	
14,000	14,000	.00072	.00008	.....	.....	
15,000	15,000	.00078	.00006	.00008	.00004	
16,000	16,000	.00084	.00006	.....	.....	
17,000	17,000	.00092	.00008	.....	.....	
18,000	18,000	.00098	.00006	.....	.....	
19,000	19,000	.00104	.00006	.....	.....	
20,000	20,000	.00110	.00006	.00016	.00008	
21,000	21,000	.00118	.00008	.....	.....	
22,000	22,000	.00124	.00006	.....	.....	
23,000	23,000	.00134	.00010	.....	.....	
24,000	24,000	.00140	.00006	.....	.....	
25,000	25,000	.00150	.00010	.00030	.00004	
26,000	26,000	.00160	.00010	.....	.....	
27,000	27,000	.00168	.00008	.....	.....	
28,000	28,000	.00182	.00014	.....	.....	
29,000	29,000	.00196	.00014	.....	.....	
30,000	30,000	.00208	.00012	.00060	.00030	
31,000	31,000	.00226	.00018	.....	.....	
32,000	32,000	.00246	.00020	.....	.....	
33,000	33,000	.00270	.00024	.....	.....	
34,000	34,000	.00298	.00028	.....	.....	
35,000	35,000	.00324	.00026	.00148	.00088	
36,000	36,000	.00360	.00036	.....	.....	
37,000	37,000	.00396	.00036	.....	.....	
38,000	38,000	.00440	.00044	.....	.....	
39,000	39,000	.00488	.00048	.....	.....	
40,000	40,000	.00528	.00040	.00324	.00176	
41,000	41,000	.00570	.00042	.....	.....	
42,000	42,000	.00620	.00050	.....	.....	
43,000	43,000	.00670	.00050	.....	.....	
44,000	44,000	.00730	.00060	.....	.....	
45,000	45,000	.00780	.00050	.00514	.00220	
46,000	46,000	.00844	.00064	.....	.....	
47,000	47,000	.00916	.00072	.....	.....	
48,000	48,000	.00960	.00044	.....	.....	
49,000	49,000	.01030	.00070	.....	.....	
50,000	50,000	.01102	.00072	.00822	.00278	
61,800	61,800	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected downward and sidewise.

No. 1134.

Marks, $^{12\ M\ R_2\ T\ R_2}_{B\ R_{10}}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00020	.00006	0.	.....	
6,000	6,000	.00024	.00004	.....	.....	
7,000	7,000	.00030	.00006	.....	.....	
8,000	8,000	.00036	.00006	.....	.....	
9,000	9,000	.00040	.00004	.....	.....	
10,000	10,000	.00044	.00004	.00002	.00002	
11,000	11,000	.00048	.00004	.....	.....	
12,000	12,000	.00056	.00008	.....	.....	
13,000	13,000	.00060	.00004	.....	.....	
14,000	14,000	.00064	.00004	.....	.....	
15,000	15,000	.00070	.00006	.00004	.00002	
16,000	16,000	.00076	.00006	.....	.....	
17,000	17,000	.00082	.00006	.....	.....	
18,000	18,000	.00086	.00004	.....	.....	
19,000	19,000	.00092	.00006	.....	.....	
20,000	20,000	.00098	.00006	.00010	.00006	
21,000	21,000	.00104	.00006	.....	.....	
22,000	22,000	.00112	.00008	.....	.....	
23,000	23,000	.00118	.00006	.....	.....	
24,000	24,000	.00124	.00006	.....	.....	
25,000	25,000	.00132	.00008	.00020	.00010	
26,000	26,000	.00140	.00008	.....	.....	
27,000	27,000	.00150	.00010	.....	.....	
28,000	28,000	.00160	.00010	.....	.....	
29,000	29,000	.00174	.00014	.....	.....	
30,000	30,000	.00182	.00008	.00044	.00024	
31,000	31,000	.00200	.00018	.....	.....	
32,000	32,000	.00220	.00020	.....	.....	
33,000	33,000	.00234	.00014	.....	.....	
34,000	34,000	.00254	.00020	.....	.....	
35,000	35,000	.00280	.00026	.00120	.00076	
36,000	36,000	.00318	.00038	.....	.....	
37,000	37,000	.00348	.00030	.....	.....	
38,000	38,000	.00386	.00038	.....	.....	
39,000	39,000	.00428	.00042	.....	.....	
40,000	40,000	.00462	.00034	.00274	.00154	
41,000	41,000	.00500	.00038	.....	.....	
42,000	42,000	.00540	.00040	.....	.....	
43,000	43,000	.00588	.00048	.....	.....	
44,000	44,000	.00624	.00036	.....	.....	
45,000	45,000	.00670	.00046	.00452	.00178	
46,000	46,000	.00710	.00040	.....	.....	
47,000	47,000	.00746	.00036	.....	.....	
48,000	48,000	.00778	.00032	.....	.....	
49,000	49,000	.00802	.00024	.....	.....	
50,000	50,000	.00820	.00018	.00586	.00134	
60,800	60,800	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected upward.

No. 1135.

Marks, $12\,\frac{M\,R_2}{M\,T_2}\,T\,B_1$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads. Total.	Applied loads. Per square inch.	Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004			
3,000	3,000	.00008	.00004			
4,000	4,000	.00014	.00006			
5,000	5,000	.00020	.00006	0.		
6,000	6,000	.00026	.00006			
7,000	7,000	.00032	.00006			
8,000	8,000	.00036	.00004			
9,000	9,000	.00040	.00004			
10,000	10,000	.00044	.00004	0.		
11,000	11,000	.00050	.00006			
12,000	12,000	.00056	.00006			
13,000	13,000	.00060	.00004			
14,000	14,000	.00064	.00004			
15,000	15,000	.00072	.00008	.00002	.00002	
16,000	16,000	.00078	.00006			
17,000	17,000	.00084	.00006			
18,000	18,000	.00088	.00004			
19,000	19,000	.00094	.00006			
20,000	20,000	.00100	.00006	.00006	.00004	
21,000	21,000	.00106	.00006			
22,000	22,000	.00112	.00006			
23,000	23,000	.00118	.00006			
24,000	24,000	.00124	.00006			
25,000	25,000	.00130	.00006	.00014	.00008	
26,000	26,000	.00136	.00006			
27,000	27,000	.00142	.00006			
28,000	28,000	.00150	.00008			
29,000	29,000	.00158	.00008			
30,000	30,000	.00164	.00006	.00022	.00008	
31,000	31,000	.00174	.00010			
32,000	32,000	.00182	.00008			
33,000	33,000	.00194	.00012			
34,000	34,000	.00204	.00010			
35,000	35,000	.00216	.00012	.00046	.00024	
36,000	36,000	.00252	.00036			
37,000	37,000	.00242	.00010			
38,000	38,000	.00260	.00018			
39,000	39,000	.00280	.00020			
40,000	40,000	.00302	.00022	.00106	.00060	
41,000	41,000	.00326	.00024			
42,000	42,000	.00354	.00028			
43,000	43,000	.00384	.00030			
44,000	44,000	.00422	.00038			
45,000	45,000	.00460	.00038	.00234	.00128	
46,000	46,000	.00508	.00048			
47,000	47,000	.00540	.00032			
48,000	48,000	.00588	.00048			
49,000	49,000	.00630	.00042			
50,000	50,000	.00672	.00042	.00418	.00184	
67,800	67,800					Ultimate strength.

Failed by **triple flexure.** Deflected obliquely upward.

Body No. 38.

No. 4947.

Marks, $\frac{12\,M\,R_2}{B\cdot T.}\,T\,R_2$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000095	.000045	.....	.....	
4,000	4,000	.000145	.000050	.....	.....	
5,000	5,000	.000180	.000035	0.	.....	
6,000	6,000	.000230	.000050	.....	.....	
7,000	7,000	.000265	.000035	.....	.....	
8,000	8,000	.000335	.000070	.....	.....	
9,000	9,000	.000395	.000060	.....	.....	
10,000	10,000	.000445	.000050	0.	.....	
11,000	11,000	.000490	.000045	.....	.....	
12,000	12,000	.000545	.000055	0.	.....	
13,000	13,000	.000600	.000055	.....	.....	
14,000	14,000	.000675	.000075	.000010	.000010	
15,000	15,000	.000750	.000075	.....	.....	
16,000	16,000	.000815	.000065	.000050	.000040	
17,000	17,000	.000905	.000090	.....	.....	
18,000	18,000	.000995	.000090	.000100	.000050	
19,000	19,000	.001100	.000105	.....	.....	
20,000	20,000	.001210	.000110	.000185	.000085	
21,000	21,000	.001340	.000130	.....	.....	
22,000	22,000	.001500	.000160	.000325	.000140	
23,000	23,000	.001660	.000160	.....	.....	
24,000	24,000	.001855	.000195	.000590	.000265	
25,000	25,000	.002115	.000260	.000785	.000195	
30,900	30,900	.....	.....	.....	.....	Tensile strength.

Fractured 6″.15 from neck. Appearance, granular.

No. 4948.

Marks, $^{12\ M\ R_2}_{M\ T_1}\ T\ R_1$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0.	.....	
6,000	6,000	.000250	.000050	.....	.....	
7,000	7,000	.000300	.000050	.....	.....	
8,000	8,000	.000350	.000050	.....	.....	
9,000	9,000	.000400	.000050	.....	.....	
10,000	10,000	.000455	.000055	.000010	.000010	
11,000	11,000	.000510	.000055	.....	.....	
12,000	12,000	.000560	.000050	.000035	.000025	
13,000	13,000	.000615	.000055	.....	.....	
14,000	14,000	.000695	.000080	.000045	.000010	
15,000	15,000	.000750	.000055	.....	.....	
16,000	16,000	.000815	.000065	.000060	.000015	
17,000	17,000	.000895	.000080	.....	.....	
18,000	18,000	.000960	.000065	.000095	.000035	
19,000	19,000	.001050	.000090	.....	.....	
20,000	20,000	.001140	.000090	.000145	.000050	
21,000	21,000	.001235	.000095	.....	.....	
22,000	22,000	.001340	.000105	.000205	.000060	
23,000	23,000	.001450	.000110	.....	.....	
24,000	24,000	.001560	.000110	.000310	.000105	
25,000	25,000	.001725	.000165	.000400	.000090	
32,400	32,400	.....	.....	.....	.....	Tensile strength.

Fractured 2″.70 from neck. Appearance, granular.

No. 1139.

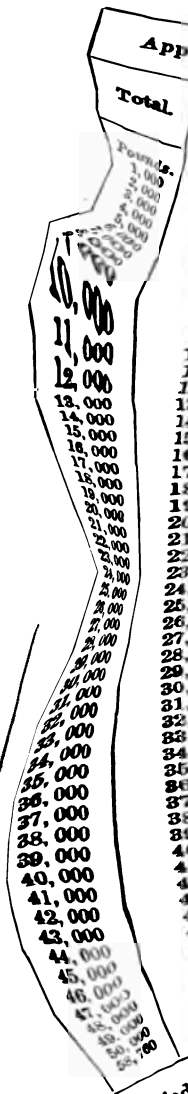
Marks, 12 M R., T R, B T.
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	....	....	
3,000	3,000	.00010	.00006	....	....	
4,000	4,000	.00014	.00004	....	....	
5,000	5,000	.00018	.00004	0.	....	
6,000	6,000	.00022	.00004	....	....	
7,000	7,000	.00028	.00006	....	....	
8,000	8,000	.00034	.00006	....	....	
9,000	9,000	.00038	.00004	....	....	
10,000	10,000	.00042	.00004	0.	....	
11,000	11,000	.00048	.00006	....	....	
12,000	12,000	.00054	.00006	....	....	
13,000	13,000	.00060	.00006	....	....	
14,000	14,000	.00066	.00006	....	....	
15,000	15,000	.00070	.00004	.00002	.00002	
16,000	16,000	.00074	.00004	....	....	
17,000	17,000	.00080	.00006	....	....	
18,000	18,000	.00086	.00006	....	....	
19,000	19,000	.00092	.00006	....	....	
20,000	20,000	.00098	.00006	.00008	.00006	
21,000	21,000	.00106	.00008	....	....	
22,000	22,000	.00114	.00008	....	....	
23,000	23,000	.00120	.00006	....	....	
24,000	24,000	.00126	.00006	....	....	
25,000	25,000	.00132	.00006	.00018	.00010	
26,000	26,000	.00138	.00006	....	....	
27,000	27,000	.00146	.00008	....	....	
28,000	28,000	.00154	.00008	....	....	
29,000	29,000	.00164	.00010	....	....	
30,000	30,000	.00178	.00014	.00042	.00024	
31,000	31,000	.00196	.00018	....	....	
32,000	32,000	.00214	.00018	....	....	
33,000	33,000	.00232	.00018	....	....	
34,000	34,000	.00252	.00020	....	....	
35,000	35,000	.00276	.00024	.00112	.00070	
36,000	36,000	.00308	.00032	....	....	
37,000	37,000	.00340	.00032	....	....	
38,000	38,000	.00380	.00040	....	....	
39,000	39,000	.00420	.00040	....	....	
40,000	40,000	.00462	.00042	.00274	.00162	
41,000	41,000	.00500	.00038	....	....	
42,000	42,000	.00552	.00052	....	....	
43,000	43,000	.00608	.00056	....	....	
44,000	44,000	.00656	.00048	....	....	
45,000	45,000	.00698	.00042	.00482	.00208	
46,000	46,000	.00750	.00052	....	....	
47,000	47,000	.00792	.00042	....	....	
48,000	48,000	.00832	.00040	....	....	
49,000	49,000	.00868	.00036	....	....	
50,000	50,000	.00894	.00026	.00664	.00182	
59,420	59,420	....	....	....	....	Ultimate strength.

Failed by triple flexure. Deflected obliquely upward.

No. 1140.

Marks, 12 M R_{28} T R_2 B R_{10}
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.



Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
		0.	0.	0.	0.	Initial load.
1,000	1,000	.00006	.00006			
2,000	2,000	.00010	.00004			
3,000	3,000	.00014	.00004			
4,000	4,000	.00020	.00006	0.		
5,000	5,000	.00024	.00004			
6,000	6,000	.00030	.00006			
7,000	7,000	.00034	.00004			
8,000	8,000	.00038	.00004			
9,000	9,000	.00042	.00004	.00002	.00002	
10,000	10,000	.00048	.00006			
11,000	11,000	.00054	.00006			
12,000	12,000	.00060	.00006			
13,000	13,000	.00064	.00004			
14,000	14,000	.00070	.00006	.00006	.00004	
15,000	15,000	.00076	.00006			
16,000	16,000	.00082	.00006			
17,000	17,000	.00088	.00006			
18,000	18,000	.00094	.00006			
19,000	19,000	.00100	.00006	.00010	.00004	
20,000	20,000	.00106	.00006			
21,000	21,000	.00112	.00006			
22,000	22,000	.00118	.00006			
23,000	23,000	.00124	.00006			
24,000	24,000	.00130	.00006	.00020	.00010	
25,000	25,000	.00138	.00008			
26,000	26,000	.00148	.00010			
27,000	27,000	.00158	.00010			
28,000	28,000	.00170	.00012			
29,000	29,000	.00182	.00012	.00046	.00026	
30,000	30,000	.00198	.00016			
31,000	31,000	.00216	.00018			
32,000	32,000	.00236	.00020			
33,000	33,000	.00262	.00026			
34,000	34,000	.00288	.00026	.00126	.00080	
35,000	35,000	.00316	.00028			
36,000	36,000	.00354	.00038			
37,000	37,000	.00398	.00044			
38,000	38,000	.00440	.00042			
39,000	39,000	.00482	.00042	.00208	.00172	
40,000	40,000	.00530	.00048			
41,000	41,000	.00580	.00050			
42,000	42,000	.00634	.00054			
43,000	43,000	.00686	.00052			
44,000	44,000	.00738	.00052	.00522	.00224	
45,000	45,000	.00800	.00052			
46,000	46,000	.00838	.00038			
47,000	47,000	.00880	.00042			
48,000	48,000	.00934	.00054			
49,000	49,000	.00982	.00048	.00742	.00220	
50,000	50,000					Ultimate strength.
58,760	58,760					

Failed by triple flexure. Deflected horizontally and upward.

No. 1141.

Marks, $\frac{12\,M\,R_2\,T\,R_1}{M\,T_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00006	.....	.....	
4,000	4,000	.00016	.00004	.....	.....	
5,000	5,000	.00022	.00006	0.	.....	
6,000	6,000	.00028	.00006	.....	.....	
7,000	7,000	.00032	.00004	.....	.....	
8,000	8,000	.00038	.00006	.....	.....	
9,000	9,000	.00042	.00004	.....	.....	
10,000	10,000	.00048	.00006	.00004	.00004	
11,000	11,000	.00052	.00004	.....	.....	
12,000	12,000	.00058	.00006	.....	.....	
13,000	13,000	.00064	.00006	.....	.....	
14,000	14,000	.00068	.00004	.....	.....	
15,000	15,000	.00074	.00006	.00008	.00004	
16,000	16,000	.00080	.00006	.....	.....	
17,000	17,000	.00086	.00006	.....	.....	
18,000	18,000	.00092	.00006	.....	.....	
19,000	19,000	.00098	.00006	.....	.....	
20,000	20,000	.00102	.00004	.00012	.00004	
21,000	21,000	.00108	.00006	.....	.....	
22,000	22,000	.00114	.00006	.....	.....	
23,000	23,000	.00120	.00006	.....	.....	
24,000	24,000	.00126	.00006	.....	.....	
25,000	25,000	.00132	.00006	.00016	.00004	
26,000	26,000	.00140	.00008	.....	.....	
27,000	27,000	.00146	.00006	.....	.....	
28,000	28,000	.00154	.00008	.....	.....	
29,000	29,000	.00162	.00008	.....	.....	
30,000	30,000	.00172	.00010	.00028	.00012	
31,000	31,000	.00178	.00006	.....	.....	
32,000	32,000	.00186	.00008	.....	.....	
33,000	33,000	.00196	.00010	.....	.....	
34,000	34,000	.00206	.00010	.....	.....	
35,000	35,000	.00216	.00010	.00048	.00020	
36,000	36,000	.00234	.00018	.....	.....	
37,000	37,000	.00248	.00014	.....	.....	
38,000	38,000	.00262	.00014	.....	.....	
39,000	39,000	.00278	.00016	.....	.....	
40,000	40,000	.00300	.00022	.00104	.00056	
41,000	41,000	.00334	.00034	.....	.....	
42,000	42,000	.00354	.00020	.....	.....	
43,000	43,000	.00384	.00030	.....	.....	
44,000	44,000	.00418	.00034	.....	.....	
45,000	45,000	.00456	.00038	.00238	.00134	
46,000	46,000	.00512	.00056	.....	.....	
47,000	47,000	.00558	.00046	.....	.....	
48,000	48,000	.00602	.00044	.....	.....	
49,000	49,000	.00660	.00058	.....	.....	
50,000	50,000	.00730	.00070	.00468	.00230	
64,710	64,710	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected horizontally.

Body No. 39.

No. 4954.

Marks, $^{12\,M\,R_2\,T\,R_2}_{B\,T_1}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000190	.000040	0.	.....	
6,000	6,000	.000235	.000045	.....	.....	
7,000	7,000	.000295	.000060	.....	.....	
8,000	8,000	.000340	.000045	.....	.....	
9,000	9,000	.000395	.000055	.....	.....	
10,000	10,000	.000450	.000055	0.	.....	
11,000	11,000	.000500	.000050	.....	.....	
12,000	12,000	.000555	.000055	.....	.....	
13,000	13,000	.000610	.000055	.....	.....	
14,000	14,000	.000675	.000065	.000015	.000015	
15,000	15,000	.000740	.000065	.....	.....	
16,000	16,000	.000815	.000075	.000050	.000035	
17,000	17,000	.000890	.000075	.....	.....	
18,000	18,000	.000965	.000075	.000090	.000040	
19,000	19,000	.001050	.000085	.....	.....	
20,000	20,000	.001150	.000100	.000150	.000060	
21,000	21,000	.001250	.000100	.....	.....	
22,000	22,000	.001360	.000110	.000250	.000100	
23,000	23,000	.001500	.000140	.....	.....	
24,000	24,000	.001650	.000150	.000395	.000145	
25,000	25,000	.001845	.000195	.000510	.000115	
29,990	29,990	.....	.....	.....	.....	Tensile strength.

Fractured ″.75 from neck. Appearance, granular, with dark spangles.

No. 4955.

Marks, $^{12\,M\,R_2\,T\,R_1}_{M\,T_1}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000195	.000045	0.	.....	
6,000	6,000	.000240	.000045	.....	.....	
7,000	7,000	.000290	.000050	.....	.....	
8,000	8,000	.000340	.000050	.....	.....	
9,000	9,000	.000395	.000055	.....	.....	
10,000	10,000	.000445	.000050	.000005	.000005	
11,000	11,000	.000495	.000050	.....	.....	
12,000	12,000	.000550	.000055	.000015	.000010	
13,000	13,000	.000610	.000060	.....	.....	
14,000	14,000	.000675	.000065	.000020	.000005	
15,000	15,000	.000740	.000065	.....	.....	
16,000	16,000	.000795	.000055	.000050	.000030	
17,000	17,000	.000860	.000065	.....	.....	
18,000	18,000	.000945	.000085	.000090	.000040	
19,000	19,000	.001005	.000060	.....	.....	
20,000	20,000	.001095	.000090	.000115	.000025	
21,000	21,000	.001175	.000080	.....	.....	
22,000	22,000	.001255	.000080	.000175	.000060	
23,000	23,000	.001360	.000105	.....	.....	
24,000	24,000	.001475	.000115	.000250	.000075	
25,000	25,000	.001600	.000125	.000305	.000055	
33,100	33,100	.....	.....	.....	.....	Tensile strength.

Fractured 1″.7 from neck. Appearance, granular.

No. 1142.

Marks, $^{12\ M\ R}_{B\ T}$, T R.
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads. Total.	Applied loads. Per square inch.	Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
1,000	1,000	0-	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006			
3,000	3,000	.00010	.00004			
4,000	4,000	.00016	.00006			
5,000	5,000	.00020	.00004	0.		
6,000	6,000	.00024	.00004			
7,000	7,000	.00030	.00006			
8,000	8,000	.00036	.00006			
9,000	9,000	.00040	.00004			
10,000	10,000	.00044	.00004	0.		
11,000	11,000	.00050	.00006			
12,000	12,000	.00056	.00006			
13,000	13,000	.00062	.00006			
14,000	14,000	.00068	.00006			
15,000	15,000	.00074	.00006	.00004	.00004	
16,000	16,000	.00080	.00006			
17,000	17,000	.00086	.00006			
18,000	18,000	.00092	.00006			
19,000	19,000	.00098	.00006			
20,000	20,000	.00104	.00006	.00014	.00010	
21,000	21,000	.00112	.00008			
22,000	22,000	.00118	.00006			
23,000	23,000	.00126	.00008			
24,000	24,000	.00134	.00008			
25,000	25,000	.00140	.00006	.00022	.00008	
26,000	26,000	.00148	.00008			
27,000	27,000	.00158	.00010			
28,000	28,000	.00168	.00010			
29,000	29,000	.00178	.00010			
30,000	30,000	.00192	.00014	.00050	.00028	
31,000	31,000	.00208	.00016			
32,000	32,000	.00222	.00014			
33,000	33,000	.00242	.00020			
34,000	34,000	.00266	.00024			
35,000	35,000	.00288	.00022	.00118	.00068	
36,000	36,000	.00318	.00030			
37,000	37,000	.00346	.00028			
38,000	38,000	.00388	.00042			
39,000	39,000	.00420	.00032			
40,000	40,000	.00460	.00040	.00268	.00150	
41,000	41,000	.00506	.00046			
42,000	42,000	.00556	.00050			
43,000	43,000	.00600	.00044			
44,000	44,000	.00640	.00040			
45,000	45,000	.00690	.00050	.00466	.00198	
46,000	46,000	.00748	.00058			
47,000	47,000	.00792	.00044			
48,000	48,000	.00830	.00038			
49,000	49,000	.00880	.00050			
50,000	50,000	.00936	.00056	.00686	.00220	
61,980	61,980	----------	----------	----------	----------	Ultimate strength.

Failed by triple flexure. Deflected obliquely upward.

No. 1143.

Marks, $\frac{12\,M\,R_{20}\,T\,R_2}{B\,R_{10}}$
Length, 10″.5.
Diameter 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00006	.....	.....	
4,000	4,000	.00016	.00004	.....	.....	
5,000	5,000	.00020	.00004	.00002	.00002	
6,000	6,000	.00024	.00004	.....	.....	
7,000	7,000	.00030	.00006	.....	.....	
8,000	8,000	.00036	.00006	.....	.....	
9,000	9,000	.00040	.00004	.....	.....	
10,000	10,000	.00044	.00004	.00004	.00002	
11,000	11,000	.00050	.00006	.....	.....	
12,000	12,000	.00056	.00006	.....	.....	
13,000	13,000	.00060	.00004	.....	.....	
14,000	14,000	.00066	.00006	.....	.....	
15,000	15,000	.00074	.00008	.00006	.00002	
16,000	16,000	.00078	.00004	.....	.....	
17,000	17,000	.00082	.00004	.....	.....	
18,000	18,000	.00088	.00006	.....	.....	
19,000	19,000	.00094	.00006	.....	.....	
20,000	20,000	.00100	.00006	.00014	.00008	
21,000	21,000	.00108	.00008	.....	.....	
22,000	22,000	.00114	.00006	.....	.....	
23,000	23,000	.00120	.00006	.....	.....	
24,000	24,000	.00126	.00006	.....	.....	
25,000	25,000	.00134	.00008	.00020	.00006	
26,000	26,000	.00142	.00008	.....	.....	
27,000	27,000	.00152	.00010	.....	.....	
28,000	28,000	.00160	.00008	.....	.....	
29,000	29,000	.00172	.00012	.....	.....	
30,000	30,000	.00182	.00010	.00044	.00024	
31,000	31,000	.00196	.00014	.....	.....	
32,000	32,000	.00216	.00020	.....	.....	
33,000	33,000	.00230	.00014	.....	.....	
34,000	34,000	.00252	.00022	.....	.....	
35,000	35,000	.00280	.00028	.00116	.00072	
36,000	36,000	.00310	.00030	.....	.....	
37,000	37,000	.00346	.00036	.....	.....	
38,000	38,000	.00380	.00034	.....	.....	
39,000	39,000	.00420	.00040	.....	.....	
40,000	40,000	.00460	.00040	.00268	.00152	
41,000	41,000	.00506	.00046	.....	.....	
42,000	42,000	.00556	.00050	.....	.....	
43,000	43,000	.00600	.00044	.....	.....	
44,000	44,000	.00648	.00048	.....	.....	
45,000	45,000	.00704	.00056	.00484	.00216	
46,000	46,000	.00744	.00040	.....	.....	
47,000	47,000	.00780	.00036	.....	.....	
48,000	48,000	.00830	.00050	.....	.....	
49,000	49,000	.00884	.00054	.....	.....	
50,000	50,000	.00926	.00042	.00680	.00196	
59,100	59,100	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected sidewise.

No. 1144.

Marks, $\frac{12\,M\,R_2\,T\,B_1}{M\,T_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00010	.00004	.....	.....	
4,000	4,000	.00016	.00006	.....	.....	
5,000	5,000	.00020	.00004	0.	.....	
6,000	6,000	.00024	.00004	.....	.....	
7,000	7,000	.00028	.00004	.....	.....	
8,000	8,000	.00034	.00006	.....	.....	
9,000	9,000	.00040	.00006	.....	.....	
10,000	10,000	.00044	.00004	.00002	.00002	
11,000	11,000	.00048	.00004	.....	.....	
12,000	12,000	.00054	.00006	.....	.....	
13,000	13,000	.00060	.00006	.....	.....	
14,000	14,000	.00066	.00006	.....	.....	
15,000	15,000	.00070	.00004	.00004	.00002	
16,000	16,000	.00076	.00006	.....	.....	
17,000	17,000	.00082	.00006	.....	.....	
18,000	18,000	.00086	.00004	.....	.....	
19,000	19,000	.00090	.00004	.....	.....	
20,000	20,000	.00096	.00006	.00006	.00002	
21,000	21,000	.00102	.00006	.....	.....	
22,000	22,000	.00108	.00006	.....	.....	
23,000	23,000	.00114	.00006	.....	.....	
24,000	24,000	.00120	.00006	.....	.....	
25,000	25,000	.00126	.00006	.00014	.00008	
26,000	26,000	.00132	.00006	.....	.....	
27,000	27,000	.00138	.00006	.....	.....	
28,000	28,000	.00144	.00006	.....	.....	
29,000	29,000	.00152	.00008	.....	.....	
30,000	30,000	.00160	.00008	.00020	.00006	
31,000	31,000	.00166	.00006	.....	.....	
32,000	32,000	.00176	.00010	.....	.....	
33,000	33,000	.00184	.00008	.....	.....	
34,000	34,000	.00194	.00010	.....	.....	
35,000	35,000	.00200	.00006	.00040	.00020	
36,000	36,000	.00214	.00014	.....	.....	
37,000	37,000	.00224	.00010	.....	.....	
38,000	38,000	.00240	.00016	.....	.....	
39,000	39,000	.00254	.00014	.....	.....	
40,000	40,000	.00268	.00014	.00080	.00040	
41,000	41,000	.00288	.00020	.....	.....	
42,000	42,000	.00314	.00026	.....	.....	
43,000	43,000	.00340	.00026	.....	.....	
44,000	44,000	.00370	.00030	.....	.....	
45,000	45,000	.00402	.00032	.00186	.00106	
46,000	46,000	.00440	.00038	.....	.....	
47,000	47,000	.00480	.00040	.....	.....	
48,000	48,000	.00516	.00036	.....	.....	
49,000	49,000	.00560	.00044	.....	.....	
50,000	50,000	.00602	.00042	.00360	.00174	
67,600	67,600	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected obliquely upward.

Body No. 40.

No. 4964.

Marks, $^{12\ M\ R_{40}\ T\ R_2}_{B\ T_1}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000045	.000045	.....	.....	
3,000	3,000	.000095	.000050	.....	.....	
4,000	4,000	.000140	.000045	.....	.....	
5,000	5,000	.000185	.000045	0.	.....	
6,000	6,000	.000235	.000050	.....	.....	
7,000	7,000	.000290	.000055	.....	.....	
8,000	8,000	.000340	.000050	.....	.....	
9,000	9,000	.000395	.000055	.....	.....	
10,000	10,000	.000445	.000050	0.	.....	
11,000	11,000	.000500	.000055	.....	.....	
12,000	12,000	.000550	.000050	.000015	.000015	
13,000	13,000	.000610	.000060	.....	.....	
14,000	14,000	.000665	.000055	.000045	.000030	
15,000	15,000	.000740	.000075	.....	.....	
16,000	16,000	.000805	.000065	.000060	.000015	
17,000	17,000	.000880	.000075	.....	.....	
18,000	18,000	.000955	.000075	.000105	.000045	
19,000	19,000	.001045	.000090	.....	.....	
20,000	20,000	.001135	.000090	.000170	.000065	
21,000	21,000	.001245	.000110	.....	.....	
22,000	22,000	.001350	.000105	.000250	.000080	
23,000	23,000	.001500	.000150	.....	.....	
24,000	24,000	.001610	.000110	.000400	.000150	
25,000	25,000	.001850	.000240	.000550	.000150	
32,180	32,180	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance, granular.

No. 4965.

Marks, 12 M R T R, M T.
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads. Total.	Per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	Pounds.	Inch.	Inch.	Inch.	Inch.	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050			
3,000	3,000	.000100	.000050			
4,000	4,000	.000150	.000050			
5,000	5,000	.000200	.000050	0.		
6,000	6,000	.000250	.000050			
7,000	7,000	.000300	.000050			
8,000	8,000	.000350	.000050			
9,000	9,000	.000400	.000050			
10,000	10,000	.000450	.000050	.000010	.000010	
11,000	11,000	.000505	.000055			
12,000	12,000	.000560	.000055	.000015	.000005	
13,000	13,000	.000620	.000060			
14,000	14,000	.000690	.000070	.000035	.000020	
15,000	15,000	.000750	.000060			
16,000	16,000	.000805	.000055	.000050	.000015	
17,000	17,000	.000885	.000080			
18,000	18,000	.000945	.000060	.000080	.000030	
19,000	19,000	.001020	.000075			
20,000	20,000	.001100	.000080	.000105	.000025	
21,000	21,000	.001205	.000105			
22,000	22,000	.001290	.000085	.000190	.000085	
23,000	23,000	.001380	.000090			
24,000	24,000	.001500	.000120	.000260	.000070	
25,000	25,000	.001640	.000140	.000325	.000065	
29,880	29,880					Tensile strength.

Fractured 7″.7 from neck. Appearance, granular, with coarse spangles near circumference.

No. 1145.

Marks, $\frac{12\,M\,R_2\,T\,R_2}{B\,T_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00012	.00006	.....	.....	
4,000	4,000	.00016	.00004	.....	.....	
5,000	5,000	.00020	.00004	0.	.....	
6,000	6,000	.00024	.00004	.....	.....	
7,000	7,000	.00028	.00004	.....	.....	
8,000	8,000	.00034	.00006	.....	.....	
9,000	9,000	.00038	.00004	.....	.....	
10,000	10,000	.00042	.00004	.00002	.00002	
11,000	11,000	.00048	.00006	.....	.....	
12,000	12,000	.00054	.00006	.....	.....	
13,000	13,000	.00060	.00006	.....	.....	
14,000	14,000	.00064	.00004	.....	.....	
15,000	15,000	.00070	.00006	.00006	.00004	
16,000	16,000	.00076	.00006	.....	.....	
17,000	17,000	.00080	.00004	.....	.....	
18,000	18,000	.00084	.00004	.....	.....	
19,000	19,000	.00090	.00006	.....	.....	
20,000	20,000	.00096	.00006	.00010	.00004	
21,000	21,000	.00102	.00006	.....	.....	
22,000	22,000	.00112	.00010	.....	.....	
23,000	23,000	.00118	.00006	.....	.....	
24,000	24,000	.00124	.00006	.....	.....	
25,000	25,000	.00130	.00006	.00020	.00010	
26,000	26,000	.00140	.00010	.....	.....	
27,000	27,000	.00146	.00006	.....	.....	
28,000	28,000	.00158	.00012	.....	.....	
29,000	29,000	.00166	.00008	.....	.....	
30,000	30,000	.00176	.00010	.00040	.00020	
31,000	31,000	.00190	.00014	.....	.....	
32,000	32,000	.00204	.00014	.....	.....	
33,000	33,000	.00222	.00018	.....	.....	
34,000	34,000	.00244	.00022	.....	.....	
35,000	35,000	.00264	.00020	.00106	.00066	
36,000	36,000	.00300	.00036	.....	.....	
37,000	37,000	.00338	.00038	.....	.....	
38,000	38,000	.00370	.00032	.....	.....	
39,000	39,000	.00400	.00030	.....	.....	
40,000	40,000	.00440	.00040	.00248	.00142	
41,000	41,000	.00482	.00042	.....	.....	
42,000	42,000	.00520	.00038	.....	.....	
43,000	43,000	.00566	.00046	.....	.....	
44,000	44,000	.00600	.00034	.....	.....	
45,000	45,000	.00650	.00050	.00440	.00192	
46,000	46,000	.00698	.00048	.....	.....	
47,000	47,000	.00736	.00038	.....	.....	
48,000	48,000	.00774	.00038	.....	.....	
49,000	49,000	.00810	.00036	.....	.....	
50,000	50,000	.00832	.00022	.00600	.00160	
61,680	61,680	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected upward.

No. 1146.

Marks, $\frac{^{12}\text{M}\,\text{R}_{10}\,\text{T}\,\text{R}_{2}}{\text{B}\,\text{R}_{19}}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00014	.00006	.....	.....	
5,000	5,000	.00018	.00004	0.	.....	
6,000	6,000	.00022	.00004	.....	.....	
7,000	7,000	.00026	.00004	.....	.....	
8,000	8,000	.00032	.00006	.....	.....	
9,000	9,000	.00036	.00004	.....	.....	
10,000	10,000	.00040	.00004	.00002	.00002	
11,000	11,000	.00048	.00008	.....	.....	
12,000	12,000	.00054	.00006	.....	.....	
13,000	13,000	.00060	.00006	.....	.....	
14,000	14,000	.00064	.00004	.....	.....	
15,000	15,000	.00068	.00004	.00004	.00002	
16,000	16,000	.00074	.00006	.....	.....	
17,000	17,000	.00080	.00006	.....	.....	
18,000	18,000	.00084	.00004	.....	.....	
19,000	19,000	.00090	.00006	.....	.....	
20,000	20,000	.00096	.00006	.00010	.00006	
21,000	21,000	.00102	.00006	.....	.....	
22,000	22,000	.00110	.00008	.....	.....	
23,000	23,000	.00116	.00006	.....	.....	
24,000	24,000	.00123	.00006	.....	.....	
25,000	25,000	.00132	.00010	.00020	.00010	
26,000	26,000	.00140	.00008	.....	.....	
27,000	27,000	.00146	.00006	.....	.....	
28,000	28,000	.00156	.00010	.....	.....	
29,000	29,000	.00168	.00012	.....	.....	
30,000	30,000	.00180	.00012	.00044	.00024	
31,000	31,000	.00196	.00016	.....	.....	
32,000	32,000	.00214	.00018	.....	.....	
33,000	33,000	.00234	.00020	.....	.....	
34,000	34,000	.00260	.00026	.....	.....	
35,000	35,000	.00284	.00024	.00122	.00078	
36,000	36,000	.00320	.00036	.....	.....	
37,000	37,000	.00356	.00036	.....	.....	
38,000	38,000	.00400	.00044	.....	.....	
39,000	39,000	.00436	.00036	.....	.....	
40,000	40,000	.00480	.00044	.00200	.00168	
41,000	41,000	.00532	.00052	.....	.....	
42,000	42,000	.00574	.00042	.....	.....	
43,000	43,000	.00620	.00046	.....	.....	
44,000	44,000	.00670	.00050	.....	.....	
45,000	45,000	.00716	.00046	.00500	.00210	
46,000	46,000	.00760	.00044	.....	.....	
47,000	47,000	.00800	.00040	.....	.....	
48,000	48,000	.00850	.00050	.....	.....	
49,000	49,000	.00892	.00042	.....	.....	
50,000	50,000	.00932	.00040	.00690	.00190	
61,600	61,600	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected obliquely upward.

No. 1147.

Marks, $\frac{12\,M\,R_2}{M\,T_2}\,T\,R_1$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006			
3,000	3,000	.00012	.00006			
4,000	4,000	.00016	.00004			
5,000	5,000	.00020	.00004	0.		
6,000	6,000	.00024	.00004			
7,000	7,000	.00030	.00006			
8,000	8,000	.00036	.00006			
9,000	9,000	.00040	.00004			
10,000	10,000	.00044	.00004	.00002	.00002	
11,000	11,000	.00050	.00006			
12,000	12,000	.00056	.00006			
13,000	13,000	.00060	.00004			
14,000	14,000	.00064	.00004			
15,000	15,000	.00070	.00006	.00006	.00004	
16,000	16,000	.00076	.00006			
17,000	17,000	.00082	.00006			
18,000	18,000	.00088	.00006			
19,000	19,000	.00094	.00006			
20,000	20,000	.00098	.00004	.00010	.00004	
21,000	21,000	.00102	.00004			
22,000	22,000	.00110	.00008			
23,000	23,000	.00116	.00006			
24,000	24,000	.00122	.00006			
25,000	25,000	.00126	.00004	.00016	.00006	
26,000	26,000	.00134	.00008			
27,000	27,000	.00140	.00006			
28,000	28,000	.00146	.00006			
29,000	29,000	.00154	.00008			
30,000	30,000	.00160	.00006	.00022	.00006	
31,000	31,000	.00168	.00008			
32,000	32,000	.00178	.00010			
33,000	33,000	.00186	.00008			
34,000	34,000	.00196	.00010			
35,000	35,000	.00204	.00008	.00042	.00020	
36,000	36,000	.00218	.00014			
37,000	37,000	.00230	.00012			
38,000	38,000	.00244	.00014			
39,000	39,000	.00256	.00012			
40,000	40,000	.00276	.00020	.00084	.00042	
41,000	41,000	.00296	.00020			
42,000	42,000	.00320	.00024			
43,000	43,000	.00342	.00022			
44,000	44,000	.00380	.00032			
45,000	45,000	.00404	.00024	.00190	.00106	
46,000	46,000	.00448	.00044			
47,000	47,000	.00478	.00030			
48,000	48,000	.00520	.00042			
49,000	49,000	.00560	.00040			
50,000	50,000	.00608	.00048	.00364	.00174	
67,420	67,420					Ultimate strength.

Failed by triple flexure. Deflected sidewise.

BODY No. 41.

No. 4976.

Marks, $^{12\,M\,R_4}_{B\,T_1}{}^{T\,R_2}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000200	.000050	0.	.....	
6,000	6,000	.000250	.000050	.....	.....	
7,000	7,000	.000300	.000050	.....	.....	
8,000	8,000	.000355	.000055	.....	.....	
9,000	9,000	.000415	.000060	.....	.....	
10,000	10,000	.000485	.000070	.000015	.000015	
11,000	11,000	.000555	.000070	.....	.....	
12,000	12,000	.000605	.000050	.000045	.000030	
13,000	13,000	.000675	.000070	.....	.....	
14,000	14,000	.000750	.000075	.000055	.000010	
15,000	15,000	.000815	.000065	.....	.....	
16,000	16,000	.000900	.000085	.000095	.000040	
17,000	17,000	.000995	.000095	.....	.....	
18,000	18,000	.001060	.000065	.000140	.000045	
19,000	19,000	.001160	.000100	.....	.....	
20,000	20,000	.001270	.000110	.000205	.000065	
21,000	21,000	.001400	.000130	.....	.....	
22,000	22,000	.001525	.000125	.000315	.000110	
23,000	23,000	.001705	.000180	.....	.....	
24,000	24,000	.001860	.000155	.000515	.000200	
25,000	25,000	.002105	.000245	.000690	.000175	
29,850	29,850	.....	.....	.....	.....	Tensile strength.

Fractured 9″.10 from neck. Appearance, granular.

No. 4977.

Marks, $\frac{12\ M\ R_{11}\ T\ R_1}{M\ T_1}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000045	.000045	.....	.....	
3,000	3,000	.000095	.000050	.....	.....	
4,000	4,000	.000140	.000045	.....	.....	
5,000	5,000	.000195	.000055	0.	.....	
6,000	6,000	.000245	.000050	.....	.....	
7,000	7,000	.000295	.000050	.....	.....	
8,000	8,000	.000345	.000050	.....	.....	
9,000	9,000	.000395	.000050	.....	.....	
10,000	10,000	.000450	.000055	0.	.....	
11,000	11,000	.000500	.000050	.....	.....	
12,000	12,000	.000555	.000055	0.	.....	
13,000	13,000	.000625	.000070	.....	.....	
14,000	14,000	.000685	.000060	.000005	.000005	
15,000	15,000	.000750	.000065	.....	.....	
16,000	16,000	.000810	.000060	.000030	.000025	
17,000	17,000	.000900	.000090	.....	.....	
18,000	18,000	.000965	.000065	.000060	.000030	
19,000	19,000	.001055	.000090	.....	.....	
20,000	20,000	.001150	.000095	.000105	.000045	
21,000	21,000	.001250	.000100	.....	.....	
22,000	22,000	.001350	.000100	.000190	.000085	
23,000	23,000	.001460	.000110	.....	.....	
24,000	24,000	.001600	.000140	.000300	.000110	
25,000	25,000	.001760	.000160	.000400	.000100	
30,850	30,850	.....	.....	.....	.....	Tensile strength.

Fractured 2″.60 from neck. Appearance of fracture, granular.

No. 1148.

Marks, $^{12\,M\,R_4\,T\,R_2}_{B\,T_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00010	.00004	.....	.....	
4,000	4,000	.00016	.00006	.....	.....	
5,000	5,000	.00020	.00004	0.	.....	
6,000	6,000	.00026	.00006	.....	.....	
7,000	7,000	.00030	.00004	.....	.....	
8,000	8,000	.00038	.00008	.....	.....	
9,000	9,000	.00042	.00004	.....	.....	
10,000	10,000	.00048	.00006	.00002	.00002	
11,000	11,000	.00054	.00006	.....	.....	
12,000	12,000	.00060	.00006	.....	.....	
13,000	13,000	.00064	.00004	.....	.....	
14,000	14,000	.00072	.00008	.....	.....	
15,000	15,000	.00080	.00008	.00008	.00006	
16,000	16,000	.00082	.00002	.....	.....	
17,000	17,000	.00090	.00008	.....	.....	
18,000	18,000	.00096	.00006	.....	.....	
19,000	19,000	.00102	.00006	.....	.....	
20,000	20,000	.00108	.00006	.00014	.00006	
21,000	21,000	.00118	.00010	.....	.....	
22,000	22,000	.00124	.00006	.....	.....	
23,000	23,000	.00130	.00006	.....	.....	
24,000	24,000	.00138	.00008	.....	.....	
25,000	25,000	.00146	.00008	.00024	.00010	
26,000	26,000	.00158	.00012	.....	.....	
27,000	27,000	.00164	.00006	.....	.....	
28,000	28,000	.00172	.00008	.....	.....	
29,000	29,000	.00184	.00012	.....	.....	
30,000	30,000	.00198	.00014	.00052	.00028	
31,000	31,000	.00212	.00014	.....	.....	
32,000	32,000	.00230	.00018	.....	.....	
33,000	33,000	.00244	.00014	.....	.....	
34,000	34,000	.00266	.00022	.....	.....	
35,000	35,000	.00284	.00018	.00114	.00002	
36,000	36,000	.00320	.00036	.....	.....	
37,000	37,000	.00344	.00024	.....	.....	
38,000	38,000	.00370	.00026	.....	.....	
39,000	39,000	.00410	.00040	.....	.....	
40,000	40,000	.00450	.00040	.00256	.00142	
41,000	41,000	.00492	.00042	.....	.....	
42,000	42,000	.00528	.00036	.....	.....	
43,000	43,000	.00570	.00042	.....	.....	
44,000	44,000	.00612	.00042	.....	.....	
45,000	45,000	.00662	.00050	.00440	.00184	
46,000	46,000	.00710	.00048	.....	.....	
47,000	47,000	.00742	.00032	.....	.....	
48,000	48,000	.00774	.00032	.....	.....	
49,000	49,000	.00808	.00034	.....	.....	
50,000	50,000	.00830	.00022	.00590	.00150	
61,250	61,250	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected obliquely.

No. 1149.

Marks, $\frac{12\ M\ R_{41}\ T\ R_2}{B\ R_{10}}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00020	.00006	0.	.....	
6,000	6,000	.00024	.00004	.....	.....	
7,000	7,000	.00030	.00006	.....	.....	
8,000	8,000	.00034	.00004	.....	.....	
9,000	9,000	.00040	.00006	.....	.....	
10,000	10,000	.00044	.00004	.00002	.00002	
11,000	11,000	.00050	.00006	.....	.....	
12,000	12,000	.00054	.00004	.....	.....	
13,000	13,000	.00060	.00006	.....	.....	
14,000	14,000	.00066	.00006	.....	.....	
15,000	15,000	.00072	.00006	.00004	.00002	
16,000	16,000	.00080	.00008	.....	.....	
17,000	17,000	.00084	.00004	.....	.....	
18,000	18,000	.00090	.00006	.....	.....	
19,000	19,000	.00094	.00004	.....	.....	
20,000	20,000	.00100	.00006	.00012	.00008	
21,000	21,000	.00110	.00010	.....	.....	
22,000	22,000	.00116	.00006	.....	.....	
23,000	23,000	.00122	.00006	.....	.....	
24,000	24,000	.00130	.00008	.....	.....	
25,000	25,000	.00138	.00008	.00022	.00010	
26,000	26,000	.00150	.00012	.....	.....	
27,000	27,000	.00156	.00006	.....	.....	
28,000	28,000	.00164	.00008	.....	.....	
29,000	29,000	.00176	.00012	.....	.....	
30,000	30,000	.00188	.00012	.00048	.00026	
31,000	31,000	.00202	.00014	.....	.....	
32,000	32,000	.00214	.00012	.....	.....	
33,000	33,000	.00236	.00022	.....	.....	
34,000	34,000	.00256	.00020	.....	.....	
35,000	35,000	.00278	.00022	.....	.....	
36,000	36,000	.00310	.00032	.00112	.00064	
37,000	37,000	.00334	.00024	.....	.....	
38,000	38,000	.00366	.00032	.....	.....	
39,000	39,000	.00404	.00038	.....	.....	
40,000	40,000	.00444	.00040	.00256	.00144	
41,000	41,000	.00492	.00048	.....	.....	
42,000	42,000	.00534	.00042	.....	.....	
43,000	43,000	.00572	.00038	.....	.....	
44,000	44,000	.00622	.00050	.....	.....	
45,000	45,000	.00674	.00052	.00470	.00214	
46,000	46,000	.00750	.00076	.....	.....	
47,000	47,000	.00780	.00030	.....	.....	
48,000	48,000	.00840	.00060	.....	.....	
49,000	49,000	.00884	.00044	.....	.....	
50,000	50,000	.00922	.00038	.00692	.00222	
63,650	63,650	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected upward.

No. 1150.

Marks, $\frac{12\ M\ R_4\ T\ R_1}{M\ T_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 3″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00020	.00006	0.	.....	
6,000	6,000	.00024	.00004	.....	.....	
7,000	7,000	.00030	.00006	.....	.....	
8,000	8,000	.00034	.00004	.....	.....	
9,000	9,000	.00038	.00004	.....	.....	
10,000	10,000	.00044	.00006	.00002	.00002	
11,000	11,000	.00050	.00006	.....	.....	
12,000	12,000	.00056	.00006	.....	.....	
13,000	13,000	.00060	.00004	.....	.....	
14,000	14,000	.00064	.00004	.....	.....	
15,000	15,000	.00070	.00006	.00006	.00004	
16,000	16,000	.00076	.00006	.....	.....	
17,000	17,000	.00082	.00006	.....	.....	
18,000	18,000	.00088	.00006	.....	.....	
19,000	19,000	.00092	.00004	.....	.....	
20,000	20,000	.00100	.00008	.00012	.00006	
21,000	21,000	.00104	.00004	.....	.....	
22,000	22,000	.00110	.00006	.....	.....	
23,000	23,000	.00120	.00010	.....	.....	
24,000	24,000	.00124	.00004	.....	.....	
25,000	25,000	.00130	.00006	.00010	.00004	
26,000	26,000	.00138	.00008	.....	.....	
27,000	27,000	.00144	.00006	.....	.....	
28,000	28,000	.00152	.00008	.....	.....	
29,000	29,000	.00160	.00008	.....	.....	
30,000	30,000	.00166	.00006	.00028	.00012	
31,000	31,000	.00176	.00010	.....	.....	
32,000	32,000	.00182	.00006	.....	.....	
33,000	33,000	.00192	.00010	.....	.....	
34,000	34,000	.00204	.00012	.....	.....	
35,000	35,000	.00212	.00008	.00048	.00020	
36,000	36,000	.00228	.00016	.....	.....	
37,000	37,000	.00240	.00012	.....	.....	
38,000	38,000	.00254	.00014	.....	.....	
39,000	39,000	.00270	.00016	.....	.....	
40,000	40,000	.00290	.00020	.00100	.00052	
41,000	41,000	.00316	.00026	.....	.....	
42,000	42,000	.00334	.00018	.....	.....	
43,000	43,000	.00352	.00018	.....	.....	
44,000	44,000	.00380	.00028	.....	.....	
45,000	45,000	.00410	.00030	.00202	.00102	
46,000	46,000	.00450	.00040	.....	.....	
47,000	47,000	.00482	.00032	.....	.....	
48,000	48,000	.00520	.00038	.....	.....	
49,000	49,000	.00560	.00040	.....	.....	
50,000	50,000	.00604	.00044	.00360	.00158	
65,450	65,450	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected sidewise.

BODY No. 42.

No. 4980.

Marks, $12\,M\,\frac{R_{11}}{B\,T_1}\,T\,R_3$
Diameter, 1''.129.
Sectional area, 1 square inch.
Length of stem, 23''.
Gauged length, 20''.

Applied loads. Total.	Applied loads. Per square inch.	Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	....	....	
3,000	3,000	.000100	.000050	....	....	
4,000	4,000	.000145	.000045	....	....	
5,000	5,000	.000190	.000045	0.	....	
6,000	6,000	.000245	.000055	....	....	
7,000	7,000	.000295	.000050	....	....	
8,000	8,000	.000345	.000050	....	....	
9,000	9,000	.000395	.000050	....	....	
10,000	10,000	.000445	.000050	.000015	.000015	
11,000	11,000	.000500	.000055	....	....	
12,000	12,000	.000555	.000055	.000040	.000025	
13,000	13,000	.000615	.000060	....	....	
14,000	14,000	.000690	.000075	.000050	.000010	
15,000	15,000	.000750	.000060	....	....	
16,000	16,000	.000815	.000065	.000090	.000040	
17,000	17,000	.000895	.000080	....	....	
18,000	18,000	.000980	.000085	.000130	.000040	
19,000	19,000	.001060	.000080	....	....	
20,000	20,000	.001150	.000090	.000200	.000070	
21,000	21,000	.001255	.000105	....	....	
22,000	22,000	.001385	.000130	.000300	.000100	
23,000	23,000	.001520	.000135	....	....	
24,000	24,000	.001680	.000160	.000455	.000155	
25,000	25,000	.001890	.000210	.000600	.000145	
30,350	30,350	....	....	....	....	Tensile strength.

Fractured 8''.40 from neck. Appearance, granular.

No. 4981.

Marks, $\frac{12 M R_2 T R_1}{M T_1}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000100	.000050	.....	.....	
4,000	4,000	.000150	.000050	.....	.....	
5,000	5,000	.000190	.000040	0.	.....	
6,000	6,000	.000245	.000055	.....	.....	
7,000	7,000	.000295	.000050	.....	.....	
8,000	8,000	.000345	.000050	.....	.....	
9,000	9,000	.000395	.000050	.....	.....	
10,000	10,000	.000445	.000050	.000005	.000005	
11,000	11,000	.000500	.000055	.....	.....	
12,000	12,000	.000550	.000050	.000030	.000025	
13,000	13,000	.000605	.000055	.....	.....	
14,000	14,000	.000670	.000065	.000045	.000015	
15,000	15,000	.000745	.000075	.....	.....	
16,000	16,000	.000800	.000055	.000055	.000010	
17,000	17,000	.000865	.000065	.....	.....	
18,000	18,000	.000945	.000080	.000095	.000040	
19,000	19,000	.001015	.000070	.....	.....	
20,000	20,000	.001100	.000085	.000135	.000040	
21,000	21,000	.001190	.000090	.....	.....	
22,000	22,000	.001265	.000075	.000195	.000060	
23,000	23,000	.001375	.000110	.....	.....	
24,000	24,000	.001500	.000125	.000280	.000085	
25,000	25,000	.001635	.000135	.000350	.000070	
30,100	30,100	.....	.....	.....	.....	Tensile strength.

Fractured at the neck. Appearance, granular.

No. 1151.

Marks, $\frac{12\,M\,R_2\,T\,R_2}{B\,T_2}$

Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00012	.00004	.....	.....	
5,000	5,000	.00018	.00006	0.	.....	
6,000	6,000	.00022	.00004	.....	.....	
7,000	7,000	.00026	.00004	.....	.....	
8,000	8,000	.00032	.00006	.....	.....	
9,000	9,000	.00036	.00004	.....	.....	
10,000	10,000	.00042	.00006	.00004	.00004	
11,000	11,000	.00050	.00008	.....	.....	
12,000	12,000	.00056	.00006	.....	.....	
13,000	13,000	.00062	.00006	.....	.....	
14,000	14,000	.00068	.00006	.....	.....	
15,000	15,000	.00072	.00004	.00008	.00004	
16,000	16,000	.00076	.00004	.....	.....	
17,000	17,000	.00080	.00004	.....	.....	
18,000	18,000	.00088	.00008	.....	.....	
19,000	19,000	.00092	.00004	.....	.....	
20,000	20,000	.00098	.00006	.00012	.00004	
21,000	21,000	.00108	.00010	.....	.....	
22,000	22,000	.00112	.00004	.....	.....	
23,000	23,000	.00120	.00008	.....	.....	
24,000	24,000	.00128	.00008	.....	.....	
25,000	25,000	.00134	.00004	.00022	.00010	
26,000	26,000	.00144	.00010	.....	.....	
27,000	27,000	.00152	.00008	.....	.....	
28,000	28,000	.00164	.00012	.....	.....	
29,000	29,000	.00178	.00014	.....	.....	
30,000	30,000	.00192	.00014	.00054	.00032	
31,000	31,000	.00210	.00018	.....	.....	
32,000	32,000	.00230	.00020	.....	.....	
33,000	33,000	.00248	.00018	.....	.....	
34,000	34,000	.00274	.00026	.....	.....	
35,000	35,000	.00318	.00044	.00152	.00098	
36,000	36,000	.00342	.00024	.....	.....	
37,000	37,000	.00374	.00032	.....	.....	
38,000	38,000	.00410	.00036	.....	.....	
39,000	39,000	.00452	.00042	.....	.....	
40,000	40,000	.00502	.00050	.00336	.00184	
41,000	41,000	.00550	.00048	.....	.....	
42,000	42,000	.00606	.00056	.....	.....	
43,000	43,000	.00652	.00046	.....	.....	
44,000	44,000	.00718	.00066	.....	.....	
45,000	45,000	.00762	.00044	.00550	.00214	
46,000	46,000	.00822	.00060	.....	.....	
47,000	47,000	.00880	.00058	.....	.....	
48,000	48,000	.00944	.00064	.....	.....	
49,000	49,000	.01022	.00078	.....	.....	
50,000	50,000	.01092	.00070	.00858	.00308	
63,550	63,550	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected downward.

No. 1152.

Marks, $\frac{12\,M\,R_9\;T\,R_2}{B\,R_{10}}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00020	.00006	0.	.....	
6,000	6,000	.00024	.00004	.....	.....	
7,000	7,000	.00028	.00004	.....	.....	
8,000	8,000	.00034	.00006	.....	.....	
9,000	9,000	.00038	.00004	.....	.....	
10,000	10,000	.00044	.00006	.00002	.00002	
11,000	11,000	.00050	.00006	.....	.....	
12,000	12,000	.00054	.00004	.....	.....	
13,000	13,000	.00060	.00006	.....	.....	
14,000	14,000	.00066	.00006	.....	.....	
15,000	15,000	.00072	.00006	.00006	.00004	
16,000	16,000	.00080	.00008	.....	.....	
17,000	17,000	.00084	.00004	.....	.....	
18,000	18,000	.00090	.00006	.....	.....	
19,000	19,000	.00094	.00004	.....	.....	
20,000	20,000	.00100	.00006	.00012	.00006	
21,000	21,000	.00108	.00008	.....	.....	
22,000	22,000	.00114	.00006	.....	.....	
23,000	23,000	.00122	.00008	.....	.....	
24,000	24,000	.00130	.00008	.....	.....	
25,000	25,000	.00138	.00008	.00022	.00010	
26,000	26,000	.00146	.00008	.....	.....	
27,000	27,000	.00154	.00008	.....	.....	
28,000	28,000	.00164	.00010	.....	.....	
29,000	29,000	.00176	.00012	.....	.....	
30,000	30,000	.00190	.00014	.00052	.00030	
31,000	31,000	.00210	.00020	.....	.....	
32,000	32,000	.00230	.00020	.....	.....	
33,000	33,000	.00246	.00016	.....	.....	
34,000	34,000	.00270	.00024	.....	.....	
35,000	35,000	.00302	.00032	.00140	.00088	
36,000	36,000	.00332	.00030	.....	.....	
37,000	37,000	.00374	.00042	.....	.....	
38,000	38,000	.00418	.00044	.....	.....	
39,000	39,000	.00462	.00044	.....	.....	
40,000	40,000	.00504	.00042	.00318	.00178	
41,000	41,000	.00560	.00056	.....	.....	
42,000	42,000	.00604	.00044	.....	.....	
43,000	43,000	.00656	.00052	.....	.....	
44,000	44,000	.00712	.00056	.....	.....	
45,000	45,000	.00786	.00074	.00570	.00252	
46,000	46,000	.00854	.00068	.....	.....	
47,000	47,000	.00894	.00040	.....	.....	
48,000	48,000	.00950	.00056	.....	.....	
49,000	49,000	.01016	.00066	.....	.....	
50,000	50,000	.01090	.00074	.00850	.00280	
62,300	62,300	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected sidewise.

No. 1153.

Marks, $\frac{12\ M\ R_{II}\ T\ R_1}{M\ T_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1.000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00012	.00008	.....	.....	
4,000	4,000	.00016	.00004	.....	.....	
5,000	5,000	.00020	.00004	.00002	.00002	
6,000	6,000	.00024	.00004	.....	.....	
7,000	7,000	.00030	.00006	.....	.....	
8,000	8,000	.00036	.00006	.....	.....	
9,000	9,000	.00040	.00004	.....	.....	
10,000	10,000	.00046	.00006	.00001	.00002	
11,000	11,000	.00050	.00004	.....	.....	
12,000	12,000	.00054	.00004	.....	.....	
13,000	13,000	.00060	.00006	.....	.....	
14,000	14,000	.00066	.00006	.....	.....	
15,000	15,000	.00070	.00004	.00008	.00004	
16,000	16,000	.00076	.00006	.....	.....	
17,000	17,000	.00080	.00004	.....	.....	
18,000	18,000	.00086	.00006	.....	.....	
19,000	19,000	.00090	.00004	.....	.....	
20,000	20,000	.00098	.00008	.00010	.00002	
21,000	21,000	.00102	.00004	.....	.....	
22,000	22,000	.00108	.00006	.....	.....	
23,000	23,000	.00112	.00004	.....	.....	
24,000	24,000	.00120	.00008	.....	.....	
25,000	25,000	.00126	.00006	.00012	.00002	
26,000	26,000	.00132	.00006	.....	.....	
27,000	27,000	.00138	.00006	.....	.....	
28,000	28,000	.00144	.00006	.....	.....	
29,000	29,000	.00152	.00008	.....	.....	
30,000	30,000	.00158	.00006	.00022	.00010	
31,000	31,000	.00166	.00008	.....	.....	
32,000	32,000	.00176	.00010	.....	.....	
33,000	33,000	.00186	.00010	.....	.....	
34,000	34,000	.00194	.00008	.....	.....	
35,000	35,000	.00206	.00012	.00044	.00022	
36,000	36,000	.00220	.00014	.....	.....	
37,000	37,000	.00230	.00010	.....	.....	
38,000	38,000	.00246	.00016	.....	.....	
39,000	39,000	.00266	.00020	.....	.....	
40,000	40,000	.00288	.00022	.00102	.00058	
41,000	41,000	.00316	.00028	.....	.....	
42,000	42,000	.00340	.00024	.....	.....	
43,000	43,000	.00372	.00032	.....	.....	
44,000	44,000	.00406	.00034	.....	.....	
45,000	45,000	.00452	.00046	.00240	.00138	
46,000	46,000	.00500	.00048	.....	.....	
47,000	47,000	.00544	.00044	.....	.....	
48,000	48,000	.00594	.00050	.....	.....	
49,000	49,000	.00650	.00056	.....	.....	
50,000	50,000	.00712	.00062	.00464	.00224	
67,750	67,750	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected upward.

No. 5008.

Marks, $^{12\,M\,R_{12}\,T\,R_{2}}_{\quad B\,T_1}$
Diameter, 1″.129.
Sectional area, 1 square inch:
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	....	....	
3,000	3,000	.000100	.000050	....	....	
4,000	4,000	.000150	.000050	....	....	
5,000	5,000	.000200	.000050	0.	....	
6,000	6,000	.000250	.000050	....	....	
7,000	7,000	.000300	.000050	....	....	
8,000	8,000	.000355	.000055	....	....	
9,000	9,000	.000405	.000050	....	....	
10,000	10,000	.000460	.000055	.000005	.000005	
11,000	11,000	.000515	.000055	....	....	
12,000	12,000	.000590	.000075	.000035	.000030	
13,000	13,000	.000650	.000060	....	....	
14,000	14,000	.000705	.000055	.000045	.000010	
15,000	15,000	.000785	.000080	....	....	
16,000	16,000	.000850	.000065	.000060	.000015	
17,000	17,000	.000930	.000080	....	....	
18,000	18,000	.001005	.000075	.000105	.000045	
19,000	19,000	.001100	.000095	....	....	
20,000	20,000	.001200	.000100	.000160	.000055	
21,000	21,000	.001290	.000090	....	....	
22,000	22,000	.001400	.000110	.000250	.000090	
23,000	23,000	.001525	.000125	....	....	
24,000	24,000	.001675	.000150	.000400	.000150	
25,000	25,000	.001850	.000175	.000500	.000100	
26,410	26,410	....	....	....	....	Tensile strength.

Fractured 11″ from the neck. Appearance, granular: coarse spangles on one side.

No. 5009.

Marks, $\frac{12\ M\ R_{42}\ T\ B_1}{M\ T_1}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000085	.000035	.....	.....	
4,000	4,000	.000130	.000045	.....	.....	
5,000	5,000	.000180	.000050	0.	.....	
6,000	6,000	.000230	.000050	.....	.....	
7,000	7,000	.000285	.000055	.....	.....	
8,000	8,000	.000335	.000050	.....	.....	
9,000	9,000	.000385	.000050	.....	.....	
10,000	10,000	.000435	.000050	.000005	.000005	
11,000	11,000	.000500	.000065	.....	.....	
12,000	12,000	.000560	.000060	.000010	.000005	
13,000	13,000	.000615	.000055	.....	.....	
14,000	14,000	.000670	.000055	.000020	.000010	
15,000	15,000	.000730	.000060	.....	.....	
16,000	16,000	.000795	.000065	.000030	.000010	
17,000	17,000	.000860	.000065	.....	.....	
18,000	18,000	.000925	.000065	.000065	.000035	
19,000	19,000	.001010	.000085	.....	.....	
20,000	20,000	.001085	.000075	.000105	.000040	
21,000	21,000	.001170	.000085	.....	.....	
22,000	22,000	.001260	.000090	.000145	.000040	
23,000	23,000	.001350	.000090	.....	.....	
24,000	24,000	.001450	.000100	.000220	.000075	
25,000	25,000	.001570	.000120	.000270	.000050	
31,990	31,990	.....	.....	.....	.....	Tensile strength.

Fractured 1″.3 from the neck. Appearance, granular.

No. 1157.

Marks, $\frac{12\ M\ R_2\ T\ R_2}{B\ T}$,
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1, 000	1, 000	0.	0.	0.	0.	Initial load.
2, 000	2, 000	.00004	.00004	.....	.....	
3, 000	3, 000	.00008	.00004	.....	.....	
4, 000	4, 000	.00012	.00004	.....	.....	
5, 000	5, 000	.00016	.00004	0.	.....	
6, 000	6, 000	.00020	.00004	.....	.....	
7, 000	7, 000	.00024	.00004	.....	.....	
8, 000	8, 000	.00030	.00006	.....	.....	
9, 000	9, 000	.00034	.00004	.....	.....	
10, 000	10, 000	.00038	.00004	0.	.....	
11, 000	11, 000	.00044	.00006	.....	.....	
12, 000	12, 000	.00048	.00004	.....	.....	
13, 000	13, 000	.00054	.00006	.....	.....	
14, 000	14, 000	.00060	.00006	.....	.....	
15, 000	15, 000	.00066	.00006	0.	.....	
16, 000	16, 000	.00072	.00006	.....	.....	
17, 000	17, 000	.00080	.00008	.....	.....	
18, 000	18, 000	.00086	.00006	.....	.....	
19, 000	19, 000	.00092	.00006	.....	.....	
20, 000	20, 000	.00098	.00006	.00004	.00004	
21, 000	21, 000	.00104	.00006	.....	.....	
22, 000	22, 000	.00112	.00008	.....	.....	
23, 000	23, 000	.00120	.00008	.....	.....	
24, 000	24, 000	.00126	.00006	.....	.....	
25, 000	25, 000	.00132	.00006	.00016	.00012	
26, 000	26, 000	.00138	.00006	.....	.....	
27, 000	27, 000	.00144	.00006	.....	.....	
28, 000	28, 000	.00152	.00008	.....	.....	
29, 000	29, 000	.00162	.00010	.....	.....	
30, 000	30, 000	.00172	.00010	.00034	.00018	
31, 000	31, 000	.00184	.00012	.....	.....	
32, 000	32, 000	.00200	.00016	.....	.....	
33, 000	33, 000	.00216	.00016	.....	.....	
34, 000	34, 000	.00236	.00020	.....	.....	
35, 000	35, 000	.00256	.00020	.00090	.00056	
36, 000	36, 000	.00282	.00026	.....	.....	
37, 000	37, 000	.00308	.00026	.....	.....	
38, 000	38, 000	.00338	.00030	.....	.....	
39, 000	39, 000	.00370	.00032	.....	.....	
40, 000	40, 000	.00406	.00036	.00218	.00128	
41, 000	41, 000	.00454	.00048	.....	.....	
42, 000	42, 000	.00490	.00036	.....	.....	
43, 000	43, 000	.00538	.00048	.....	.....	
44, 000	44, 000	.00582	.00044	.....	.....	
45, 000	45, 000	.00636	.00052	.00412	.00194	
46, 000	46, 000	.00692	.00056	.....	.....	
47, 000	47, 000	.00736	.00044	.....	.....	
48, 000	48, 000	.00790	.00054	.....	.....	
49, 000	49, 000	.00844	.00054	.....	.....	
50, 000	50, 000	.00890	.00046	.00638	.00226	
63, 790	63, 790	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected upward.

No. 1158.

Marks, $\frac{12\,M\,R_{12}\,T\,R_2}{B\,R_{10}}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004			
3,000	3,000	.00008	.00004			
4,000	4,000	.00014	.00006			
5,000	5,000	.00018	.00004	0.		
6,000	6,000	.00022	.00004			
7,000	7,000	.00026	.00004			
8,000	8,000	.00032	.00006			
9,000	9,000	.00036	.00004			
10,000	10,000	.00042	.00006	0.		
11,000	11,000	.00048	.00006			
12,000	12,000	.00052	.00004			
13,000	13,000	.00058	.00006			
14,000	14,000	.00064	.00006			
15,000	15,000	.00070	.00006	.00002	.00002	
16,000	16,000	.00076	.00006			
17,000	17,000	.00080	.00004			
18,000	18,000	.00086	.00006			
19,000	19,000	.00092	.00006			
20,000	20,000	.00096	.00004	.00008	.00006	
21,000	21,000	.00102	.00006			
22,000	22,000	.00110	.00008			
23,000	23,000	.00118	.00008			
24,000	24,000	.00124	.00006			
25,000	25,000	00130	.00006	.00018	.00010	
26,000	26,000	.00138	.00008			
27,000	27,000	.00144	.00006			
28,000	28,000	.00154	.00010			
29,000	29,000	.00162	.00008			
30,000	30,000	.00172	.00010	.00036	.00018	
31,000	31,000	.00184	.00012			
32,000	32,000	.00198	.00014			
33,000	33,000	.00214	.00016			
34,000	34,000	.00232	.00018			
35,000	35,000	.00254	.00022	.00092	.00056	
36,000	36,000	.00280	.00026			
37,000	37,000	.00310	.00030			
38,000	38,000	.00340	.00030			
39,000	39,000	.00376	.00036			
40,000	40,000	.00414	.00038	.00226	.00134	
41,000	41,000	.00460	.00046			
42,000	42,000	.00500	.00040			
43,000	43,000	.00542	.00042			
44,000	44,000	.00590	.00048			
45,000	45,000	.00638	.00048	.00428	.00202	
46,000	46,000	.00694	.00056			
47,000	47,000	.00740	.00046			
48,000	48,000	.00800	.00060			
49,000	49,000	.00864	.00064			
50,000	50,000	.00930	.00066	.00682	.00254	
61,050	61,050					Ultimate strength.

Failed by triple flexure. Deflected sidewise.

No. 1159.

Marks, $\frac{12\ M\ R_2,\ T\ R_1}{M\ T_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00014	.00006	.....	.....	
5,000	5,000	.00018	.00004	0.	.....	
6,000	6,000	.00022	.00004	.....	.....	
7,000	7,000	.00028	.00006	.....	.....	
8,000	8,000	.00032	.00004	.....	.....	
9,000	9,000	.00036	.00004	.....	.....	
10,000	10,000	.00040	.00004	0.	.....	
11,000	11,000	.00046	.00006	.....	.....	
12,000	12,000	.00054	.00008	.....	.....	
13,000	13,000	.00060	.00006	.....	.....	
14,000	14,000	.00064	.00004	.....	.....	
15,000	15,000	.00068	.00004	.00002	.00002	
16,000	16,000	.00074	.00006	.....	.....	
17,000	17,000	.00078	.00004	.....	.....	
18,000	18,000	.00084	.00006	.....	.....	
19,000	19,000	.00090	.00006	.....	.....	
20,000	20,000	.00096	.00006	.00006	.00004	
21,000	21,000	.00100	.00004	.....	.....	
22,000	22,000	.00104	.00004	.....	.....	
23,000	23,000	.00112	.00008	.....	.....	
24,000	24,000	.00118	.00006	.....	.....	
25,000	25,000	.00124	.00006	.00012	.00006	
26,000	26,000	.00130	.00006	.....	.....	
27,000	27,000	.00138	.00008	.....	.....	
28,000	28,000	.00144	.00006	.....	.....	
29,000	29,000	.00150	.00006	.....	.....	
30,000	30,000	.00156	.00006	.00020	.00008	
31,000	31,000	.00162	.00006	.....	.....	
32,000	32,000	.00170	.00008	.....	.....	
33,000	33,000	.00178	.00008	.....	.....	
34,000	34,000	.00186	.00008	.....	.....	
35,000	35,000	.00196	.00010	.00036	.00016	
36,000	36,000	.00204	.00008	.....	.....	
37,000	37,000	.00218	.00014	.....	.....	
38,000	38,000	.00230	.00012	.....	.....	
39,000	39,000	.00244	.00014	.....	.....	
40,000	40,000	.00260	.00016	.00076	.00040	
41,000	41,000	.00280	.00020	.....	.....	
42,000	42,000	.00304	.00024	.....	.....	
43,000	43,000	.00324	.00020	.....	.....	
44,000	44,000	.00352	.00028	.....	.....	
45,000	45,000	.00380	.00028	.00166	.00090	
46,000	46,000	.00420	.00040	.....	.....	
47,000	47,000	.00456	.00036	.....	.....	
48,000	48,000	.00490	.00034	.....	.....	
49,000	49,000	.00534	.00044	.....	.....	
50,000	50,000	.00570	.00036	.00334	.00168	
68,280	68,280	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected sidewise.

Body No. 43.

No. 4984.

Marks, $\frac{12\ M\ R_2\ T\ R_2}{B\ T_1}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000095	.000045	.....	.....	
4,000	4,000	.000125	.000030	.....	.....	
5,000	5,000	.000160	.000035	0.	.....	
6,000	6,000	.000205	.000045	.....	.....	
7,000	7,000	.000250	.000045	.....	.....	
8,000	8,000	.000300	.000050	.....	.....	
9,000	9,000	.000350	.000050	.....	.....	
10,000	10,000	.000405	.000055	0.	.....	
11,000	11,000	.000460	.000055	.....	.....	
12,000	12,000	.000525	.000065	.000005	.000005	
13,000	13,000	.000595	.000070	.....	.....	
14,000	14,000	.000650	.000055	.000015	.000010	
15,000	15,000	.000710	.000060	.....	.....	
16,000	16,000	.000785	.000075	.000045	.000030	
17,000	17,000	.000850	.000065	.....	.....	
18,000	18,000	.000930	.000080	.000085	.000040	
19,000	19,000	.001005	.000075	.....	.....	
20,000	20,000	.001100	.000095	.000140	.000055	
21,000	21,000	.001200	.000100	.....	.....	
22,000	22,000	.001300	.000100	.000215	.000075	
23,000	23,000	.001415	.000115	.....	.....	
24,000	24,000	.001555	.000140	.000350	.000135	
25,000	25,000	.001740	.000185	.000455	.000105	
30,550	30,550	.....	.....	.....	.....	Tensile strength.

Fractured 1″.40 from neck. Appearance, granular.

No. 4985.

Marks, $\frac{12\,M\,R_2\,T\,B_1}{M\,T_1}$
Diameter, 1″.129.
Sectional area, 1 square inch.
Length of stem, 23″.
Gauged length, 20″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.000050	.000050	.....	.....	
3,000	3,000	.000095	.000045	.....	.....	
4,000	4,000	.000145	.000050	.....	.....	
5,000	5,000	.000190	.000045	0.	.....	
6,000	6,000	.000245	.000055	.....	.....	
7,000	7,000	.000295	.000050	.....	.....	
8,000	8,000	.000345	.000050	.....	.....	
9,000	9,000	.000395	.000050	.....	.....	
10,000	10,000	.000445	.000050	.000005	.000005	
11,000	11,000	.000500	.000055	.....	.....	
12,000	12,000	.000550	.000050	.000010	.000005	
13,000	13,000	.000605	.000055	.....	.....	
14,000	14,000	.000665	.000060	.000025	.000015	
15,000	15,000	.000740	.000075	.....	.....	
16,000	16,000	.000800	.000060	.000045	.000020	
17,000	17,000	.000855	.000055	.....	.....	
18,000	18,000	.000940	.000085	.000060	.000015	
19,000	19,000	.001010	.000070	.....	.....	
20,000	20,000	.001090	.000080	.000100	.000040	
21,000	21,000	.001150	.000060	.....	.....	
22,000	22,000	.001245	.000095	.000140	.000040	
23,000	23,000	.001340	.000095	.....	.....	
24,000	24,000	.001445	.000105	.000205	.000065	
25,000	25,000	.001560	.000115	.000260	.000055	
31,100	31,100	.....	.....	.....	.....	Tensile strength.

Fractured 9″.50 from neck. Appearance, granular.

No. 1154.

Marks, $^{12\ M\ R_2}_{B\ T_2}\ ^{T\ R_2}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00008	.00004	.....	.....	
4,000	4,000	.00012	.00004	.....	.....	
5,000	5,000	.00018	.00006	0.	.....	
6,000	6,000	.00020	.00002	.....	.....	
7,000	7,000	.00024	.00004	.....	.....	
8,000	8,000	.00030	.00006	.....	.....	
9,000	9,000	.00034	.00004	.....	.....	
10,000	10,000	.00040	.00006	.00002	.00002	
11,000	11,000	.00042	.00002	.....	.....	
12,000	12,000	.00050	.00008	.....	.....	
13,000	13,000	.00056	.00006	.....	.....	
14,000	14,000	.00062	.00006	.....	.....	
15,000	15,000	.00070	.00008	.00004	.00002	
16,000	16,000	.00074	.00004	.....	.....	
17,000	17,000	.00080	.00006	.....	.....	
18,000	18,000	.00090	.00010	.....	.....	
19,000	19,000	.00096	.00006	.....	.....	
20,000	20,000	.00100	.00004	.00008	.00004	
21,000	21,000	.00104	.00004	.....	.....	
22,000	22,000	.00112	.00008	.....	.....	
23,000	23,000	.00118	.00006	.....	.....	
24,000	24,000	.00124	.00006	.....	.....	
25,000	25,000	.00134	.00010	.00016	.00008	
26,000	26,000	.00140	.00006	.....	.....	
27,000	27,000	.00148	.00008	.....	.....	
28,000	28,000	.00158	.00010	.....	.....	
29,000	29,000	.00166	.00008	.....	.....	
30,000	30,000	.00178	.00012	.00038	.00022	
31,000	31,000	.00192	.00014	.....	.....	
32,000	32,000	.00204	.00012	.....	.....	
33,000	33,000	.00220	.00016	.....	.....	
34,000	34,000	.00238	.00018	.....	.....	
35,000	35,000	.00258	.00020	.00100	.00062	
36,000	36,000	.00286	.00028	.....	.....	
37,000	37,000	.00312	.00026	.....	.....	
38,000	38,000	.00344	.00032	.....	.....	
39,000	39,000	.00378	.00034	.....	.....	
40,000	40,000	.00422	.00044	.00238	.00138	
41,000	41,000	.00460	.00038	.....	.....	
42,000	42,000	.00490	.00030	.....	.....	
43,000	43,000	.00550	.00060	.....	.....	
44,000	44,000	.00590	.00040	.....	.....	
45,000	45,000	.00640	.00050	.00434	.00196	
46,000	46,000	.00690	.00050	.....	.....	
47,000	47,000	.00732	.00042	.....	.....	
48,000	48,000	.00786	.00054	.....	.....	
49,000	49,000	.00830	.00044	.....	.....	
50,000	50,000	.00870	.00040	.00632	.00198	
63,250	63,250	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected obliquely upward.

No. 1155.

Marks, $\frac{12\ M\ R_{42}\ T\ R_2}{B\ R_{10}}$
Length, 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00006	.00006	.....	.....	
3,000	3,000	.00010	.00004	.....	.....	
4,000	4,000	.00016	.00006	.....	.....	
5,000	5,000	.00020	.00004	0.	.....	
6,000	6,000	.00022	.00002	.....	.....	
7,000	7,000	.00026	.00004	.....	.....	
8,000	8,000	.00032	.00006	.....	.....	
9,000	9,000	.00040	.00008	.....	.....	
10,000	10,000	.00048	.00008	.00002	.00002	
11,000	11,000	.00052	.00004	.....	.....	
12,000	12,000	.00056	.00004	.....	.....	
13,000	13,000	.00060	.00004	.....	.....	
14,000	14,000	.00066	.00006	.....	.....	
15,000	15,000	.00072	.00006	.00008	.00006	
16,000	16,000	.00080	.00008	.....	.....	
17,000	17,000	.00090	.00010	.....	.....	
18,000	18,000	.00092	.00002	.....	.....	
19,000	19,000	.00100	.00008	.....	.....	
20,000	20,000	.00104	.00004	.00012	.00004	
21,000	21,000	.00112	.00008	.....	.....	
22,000	22,000	.00118	.00006	.....	.....	
23,000	23,000	.00124	.00006	.....	.....	
24,000	24,000	.00132	.00008	.....	.....	
25,000	25,000	.00140	.00008	.00022	.00010	
26,000	26,000	.00148	.00008	.....	.....	
27,000	27,000	.00154	.00006	.....	.....	
28,000	28,000	.00162	.00008	.....	.....	
29,000	29,000	.00172	.00010	.....	.....	
30,000	30,000	.00184	.00012	.00046	.00024	
31,000	31,000	.00200	.00016	.....	.....	
32,000	32,000	.00210	.00010	.....	.....	
33,000	33,000	.00230	.00020	.....	.....	
34,000	34,000	.00244	.00014	.....	.....	
35,000	35,000	.00270	.00026	.00110	.00064	
36,000	36,000	.00302	.00032	.....	.....	
37,000	37,000	.00332	.00030	.....	.....	
38,000	38,000	.00358	.00026	.....	.....	
39,000	39,000	.00392	.00034	.....	.....	
40,000	40,000	.00436	.00044	.00238	.00148	
41,000	41,000	.00476	.00040	.....	.....	
42,000	42,000	.00518	.00042	.....	.....	
43,000	43,000	.00566	.00048	.....	.....	
44,000	44,000	.00624	.00058	.....	.....	
45,000	45,000	.00682	.00058	.00470	.00212	
46,000	46,000	.00740	.00058	.....	.....	
47,000	47,000	.00786	.00046	.....	.....	
48,000	48,000	.00850	.00064	.....	.....	
49,000	49,000	.00900	.00050	.....	.....	
50,000	50,000	.00970	.00070	.00728	.00258	
62,450	62,450	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected obliquely downward.

No. 1156.

Marks, $^{12}\,\mathrm{M}\,\mathrm{R}_2\,\mathrm{T}\,\mathrm{R}_1$ / $\mathrm{M}\,\mathrm{T}_2$
Length 10″.5.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 5″.

Applied loads.		Compression per inch.	Successive compression per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,000	1,000	0.	0.	0.	0.	Initial load.
2,000	2,000	.00004	.00004	.....	.....	
3,000	3,000	.00010	.00006	.....	.....	
4,000	4,000	.00014	.00004	.....	.....	
5,000	5,000	.00016	.00002	0.	.....	
6,000	6,000	.00020	.00004	.....	.....	
7,000	7,000	.00022	.00002	.....	.....	
8,000	8,000	.00028	.00006	.....	.....	
9,000	9,000	.00032	.00004	.....	.....	
10,000	10,000	.00036	.00004	0.	.....	
11,000	11,000	.00040	.00004	.....	.....	
12,000	12,000	.00048	.00008	.....	.....	
13,000	13,000	.00050	.00002	.....	.....	
14,000	14,000	.00058	.00008	.....	.....	
15,000	15,000	.00062	.00004	.....	.....	
67,550	67,550	.....	.....	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected sidewise.

12-INCH B. L. RIFLED MORTARS.

Chemical composition of cast-iron bodies.

Tension test number.	No. of body.	Mark on specimen.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.
			Total.	Graphitic.	Combined.					
4945	31	B T_1..	2.727	1.911	0.816	0.451	1.090	0.066	0.344	0.007
4946	31	M T_1..	2.451	2.099	0.352	0.449	1.042	0.065	0.317	0.005
4929	33	B T_1..	2.465	1.908	0.557	0.439	0.940	0.088	0.274	0.006
4930	33	M T_1..	2.492	1.957	0.535	0.441	1.174	0.089	0.268	0.008
4935	34	B T^1..	2.577	2.102	0.475	0.439	1.128	0.083	0.327	0.008
4936	34	M T_1..	2.568	2.099	0.469	0.432	1.128	0.096	0.338	0.008
4943	37	B T_1..	2.508	2.116	0.392	0.462	1.071	0.063	0.250	0.008
4944	37	M T_1..	2.566	1.895	0.671	0.459	1.034	0.077	0.246	0.008
4947	38	B T_1..	2.448	1.840	0.608	0.460	0.987	0.064	0.396	0.008
4948	38	M T_1..	2.459	1.854	0.605	0.457	1.062	0.061	0.271	0.010
4954	39	B T_1..	2.525	2.113	0.412	0.464	0.911	0.047	0.276	0.008
4955	39	M T_1..	2.454	1.971	0.483	0.462	1.043	0.058	0.282	0.008
4964	40	B T_1..	2.533	1.903	0.630	0.467	0.940	0.062	0.277	0.009
4965	40	M T_1..	2.549	1.914	0.635	0.459	0.902	0.066	0.285	0.005
4976	41	B T_1..	2.290	1.935	0.355	0.464	0.949	0.075	0.251	0.007
4977	41	M T_1..	2.315	1.960	0.355	0.457	1.156	0.075	0.262	0.007
4980	42	B T_1..	2.645	2.099	0.546	0.454	0.987	0.081	0.285	0.012
4981	42	M T_1..	2.549	2.094	0.455	0.470	0.883	0.078	0.280	0.009
5008	42	B T_1..	2.536	1.941	0.595	0.458	0.686	0.082	0.372	0.005
5009	42	M T_1..	2.522	1.904	0.619	0.451	0.705	0.070	0.370	0.005
4984	43	B T_1..	2.519	1.887	0.632	0.451	1.061	0.075	0.291	0.010
4985	43	B T_2..	2.339	1.881	0.458	0.458	1.090	0.080	0.267	0.010

12-INCH B. L. RIFLED MORTARS.

TABULATION OF TENSION SPECIMENS FROM CAST-IRON BODIES.

No. of test.	Number of— Mortar.	Number of— Specimen.	Position in body.	Location of specimen.	Length of stem.	Sectional area.	Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.
					Inches.	*Sq.inch.*	*Pounds.*			
4945	31	1	Breech	Inside	23	1.00	26,470	Granular, with coarse spangles.	.....	.....
4946	31	1	Muzzle	....do	23	1.00	33,180	Granular	.....	.....
487	31	3	Breech	....do	Grooved	1.00	30,390	....do	7.3136	15.05
488	31	4	....do	Outside	....do	1.00	33,280	....do	7.3309	16.31
489	31	5	....do	....do	....do	1.00	34,480	....do	7.3077	15.83
490	31	6	....do	Inside	....do	1.00	33,220	....do	.....	.....
491	31	7	....do	....do	....do	1.00	32,320	....do	.....	.....
492	31	8	....do	Outside	....do	1.00	34,150	....do	.....	.....
493	31	9	....do	....do	....do	1.00	34,270	....do	.....	.....
494	31	3	Muzzle	Inside	....do	1.00	32,400	....do	7.3314	19.49
495	31	4	....do	Outside	....do	1.00	33,820	....do	7.3349	19.70
496	31	5	....do	....do	....do	1.00	36,500	....do	7.3204	17.62
4929	33	1	Breech	Inside	23	1.00	28,330	....do	.....	.....
4930	33	1	Muzzle	....do	23	1.00	31,210	....do	.....	.....
457	33	3	Breech	....do	Grooved	1.00	32,850	....do	7.3517	17.35
458	33	4	....do	Outside	....do	1.00	32,990	....do	7.3418	17.62
459	33	5	....do	....do	....do	1.00	34,200	....do	7.3244	17.08
460	33	6	....do	Inside	....do	1.00	35,310	....do	.....	.....
861	33	7	....do	....do	....do	1.00	34,880	....do	.....	.....
462	33	8	....do	Outside	....do	1.60	34,140	....do	.....	.....
463	33	9	....do	....do	....do	1.00	33,820	....do	.....	.....
464	33	3	Muzzle	Inside	....do	1.00	34,200	....do	7.3274	18.29
465	33	4	....do	Outside	....do	1.00	32,360	....do	7.3359	17.90
466	33	5	....do	....do	....do	1.00	36,380	....do	7.3334	16.64
4935	34	1	Breech	Inside	23	1.00	26,630	Medium fine granular, with coarse dark spangles.	.....	.....
4936	34	1	Muzzle	....do	23	1.00	29,450	Granular	.....	.....
467	34	3	Breech	....do	Grooved	1.00	34,260	....do	7.2807	15.43
468	34	4	....do	Outside	....do	1.00	36,420	....do	7.2955	15.67
469	34	5	....do	....do	....do	1.00	34,390	....do	7.2763	14.54
470	34	6	....do	Inside	....do	1.00	34,650	....do	.....	.....
471	34	7	....do	....do	....do	1.00	32,600	....do	.....	.....
472	34	8	....do	Outside	....do	1.00	32,460	....do	.....	.....
473	34	9	....do	....do	....do	1.00	33,200	....do	.....	.....
474	34	3	Muzzle	Inside	....do	1.00	36,550	....do	7.2884	16.90
475	34	4	....do	Outside	....do	1.00	34,400	....do	7.2567	16.39
476	34	5	....do	....do	....do	1.00	36,700	....do	7.2690	15.13
4943	37	1	Breech	Inside	23	1.00	27,300	Granular, with coarse dark spangles.	.....	.....
4944	37	1	Muzzle	....do	23	1.00	31,240	Uniform granular, mottled.	.....	.....
477	37	3	Breech	....do	Grooved	1.00	30,800	Granular	7.3422	17.26
478	37	4	....do	Outside	....do	1.00	33,350	....do	7.3409	17.17
479	37	5	....do	....do	....do	1.00	33,600	....do	7.2928	17.26
480	37	6	....do	Inside	....do	1.00	31,000	....do	.....	.....
481	37	7	....do	....do	....do	1.00	33,900	....do	.....	.....
482	37	8	....do	Outside	....do	1.00	31,950	....do	.....	.....
483	37	9	....do	....do	....do	1.00	35,400	....do	.....	.....
484	37	3	Muzzle	Inside	....do	1.00	36,600	....do	7.3457	19.49
485	37	4	....do	Outside	....do	1.00	34,850	....do	7.3474	18.28
486	37	5	....do	....do	....do	1.00	36,000	....do	7.3375	17.44
4947	38	1	Breech	Inside	23	1.00	30,900	....do	.....	.....
4948	38	1	Muzzle	....do	23	1.00	32,400	....do	.....	.....
497	38	3	Breech	....do	Grooved	1.00	35,600	....do	7.3237	15.28
498	38	4	....do	Outside	....do	1.00	32,750	....do	7.3214	15.91
499	38	5	....do	....do	....do	1.00	33,400	....do	7.3096	15.67
500	38	6	....do	Inside	....do	1.00	34,250	....do	.....	.....
501	38	7	....do	....do	....do	1.00	31,750	....do	.....	.....
502	38	8	....do	Outside	....do	1.00	34,800	....do	.....	.....
503	38	9	....do	....do	....do	1.00	33,700	....do	.....	.....
504	38	3	Muzzle	Inside	....do	1.00	35,250	....do	7.3230	18.09
505	38	4	....do	Outside	....do	1.00	33,950	....do	7.3283	17.81
506	38	5	....do	....do	....do	1.00	37,050	....do	7.3275	16.90
4954	39	1	Breech	Inside	23	1.00	29,990	Granular, with dark spangles.	.....	.....
4955	39	1	Muzzle	....do	23	1.00	33,100	Granular	.....	.....

Tabulation of tension specimens from cast-iron bodies—Continued.

No. of test.	Number of— Mortar.	Number of— Specimen.	Position in body.	Location of specimen.	Length of stem.	Sectional area.	Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.
					Inches.	*Sq. inch.*	*Pounds.*			
507	39	3	Breech..	Inside ..	Grooved	1.00	34,980	Granular	7.3345	17.44
508	39	4	....do ...	Outside.	....do ...	1.00	33,310	.....do	7.3353	16.23
509	39	5	....do ...	....do ...	....do ...	1.00	32,700	.....do	7.3058	14.98
510	39	6	....do ...	Inside ..	....do ...	1.00	34,020	.....do	.....	.....
511	39	7	....do ...	....do ...	....do ...	1.00	35,450	.....do	.....	.....
512	39	8	....do ...	Outside.	....do ...	1.00	33,490	.....do	.....	.....
513	39	9	....do ...	....do ...	....do ...	1.00	33,060	.....do	.....	.....
514	39	3	Muzzle .	Inside ..	....do ...	1.00	34,980	.....do	7.3383	18.78
515	39	4	....do ...	Outside.	....do ...	1.00	33,820	.....do	7.3350	19.08
516	39	5	....do ...	....do ...	....do ...	1.00	36,360	.....do	7.3292	17.62
4964	40	1	Breech..	Inside ..	23	1.00	32,180	.....do	.....	.....
4965	40	1	Muzzle ..	....do ...	23	1.00	29,880	Granular, with coarse spangles.	.....	.....
517	40	3	Breech..	....do ...	Grooved	1.00	34,840	Granular	7.3416	16.73
518	40	4	....do ...	Outside.	....do ...	1.00	28,850	Granular, with coarse spangles.	7.3570	17.44
519	40	5	....do ...	....do ...	....do ...	1.00	35,970	Granular	7.3363	16.56
520	40	6	....do ...	Inside ..	....do ...	1.00	33,650	.....do	.....	.....
521	40	7	....do ...	....do ...	....do ...	1.00	35,300	.....do	.....	.....
522	40	8	....do ...	Outside.	....do ...	1.00	34,460	.....do	.....	.....
523	40	9	....do ...	....do ...	....do ...	1.00	33,900	.....do	.....	.....
524	40	3	Muzzle .	Inside ..	....do ...	1.00	33,180	.....do	7.3334	20.03
525	40	4	... do ...	Outside.	....do ...	1.00	35,100	.....do	7.3467	17.71
526	40	5	....do ...	....do ...	....do ...	1.00	36,130	.....do	7.3412	17.26
4976	41	1	Breech..	Inside ..	23	1.00	29,850	.....do	.....	.....
4977	41	1	Muzzle ..	....do ...	23	1.00	30,850	.....do	.....	.....
527	41	3	Breech..	....do ...	Grooved	1.00	30,450	.....do	7.3268	17.17
528	41	4	....do ...	Outside.	....do ...	1.00	31,700	.....do	7.3377	16.63
529	41	5	....do ...	....do ...	....do ...	1.00	33,350	.....do	7.3334	16.99
530	41	6	....do ...	Inside ..	....do ...	1.00	24,800	.....do	.....	.....
531	41	7	....do ...	....do ...	....do ...	1.00	31,050	.....do	.....	.....
532	41	8	....do ...	Outside.	....do ...	1.00	31,750	.....do	.....	.....
533	41	9	....do ...	....do ...	....do ...	1.00	32,950	.....do	.....	.....
534	41	3	Muzzle .	Inside ..	....do ...	1.00	32,400	.....do	7.3239	19.08
535	41	4	....do ...	Outside.	....do ...	1.00	29,900	.....do	7.3351	18.28
536	41	5	....do ...	....do ...	....do ...	1.00	31,300	.....do	7.3319	17.35
4980	42	1	Breech..	Inside ..	23	1.00	30,350	.....do	.....	.....
4981	42	1	Muzzle ..	....do ...	23	1.00	30,100	.....do	.....	.....
537	42	3	Breech..	....do ...	Grooved	1.00	33,350	.....do	7.3258	16.15
538	42	4	....do ...	Outside.	....do ...	1.00	34,200	.....do	7.3477	16.31
539	42	5	....do ...	....do ...	....do ...	1.00	33,650	.....do	7.3266	15.51
540	42	6	....do ...	Inside ..	....do ...	1.00	32,300	.....do	.....	.....
541	42	7	... do ...	....do ...	....do ...	1.00	33,550	.....do	.....	.....
542	42	8	....do ...	Outside.	....do ...	1.00	35,500	.....do	.....	.....
543	42	9	....do ...	....do ...	....do ...	1.00	33,900	.....do	.....	.....
544	42	3	Muzzle .	Inside ..	....do ...	1.00	35,250	.....do	7.3582	19.18
545	42	4	....do ...	Outside.	....do ...	1.00	31,900	.....do	7.3479	17.08
546	42	5	....do ...	....do ...	....do ...	1.00	32,850	.....do	7.3426	17.99
5008	42	1	Breech..	Inside ..	23	1.00	26,410	Granular, with coarse spangles.	.....	.....
5009	42	1	Muzzle ..	....do ...	23	1.00	31,990	Granular	.....	.....
565	42	3	Breech..	....do ...	Grooved	1.00	33,510	.....do	7.3438	17.08
566	42	4	....do ...	Outside.	....do ...	1.00	33,370	.....do	7.3422	17.35
567	42	5	....do ...	....do ...	....do ...	1.00	35,600	.....do	7.3232	16.23
568	42	6	....do ...	Inside ..	....do ...	1.00	27,720	.....do	.....	.....
569	42	7	....do ...	....do ...	....do ...	1.00	34,890	.....do	.....	.....
570	42	8	....do ...	Outside.	....do ...	1.00	35,220	.....do	.....	.....
571	42	9	....do ...	....do ...	....do ...	1.00	35,210	.....do	.....	.....
572	42	3	Muzzle .	Inside ..	....do ...	1.00	34,550	.....do	7.3470	19.81
573	42	4	....do ...	Outside.	....do ...	1.00	33,900	.....do	7.3448	18.68
574	42	5	....do ...	....do ...	....do ...	1.00	38,100	.....do	7.3371	18.38
4984	43	1	....do ...	Inside ..	23	1.00	30,550	.....do	.....	.....
4985	43	1	Muzzle ..	....do ...	23	1.00	31,100	.....do	.....	.....
547	43	3	Breech..	....do ...	Grooved	1.00	32,900	.....do	7.3337	16.73
548	43	4	....do ...	Outside.	....do ...	1.00	34,050	.....do	7.3413	17.08
549	43	5	....do ...	....do ...	....do ...	1.00	32,150	.....do	7.3051	15.35
550	43	6	....do ...	Inside ..	....do ...	1.00	25,350	.....do	.....	.....
551	43	7	....do ...	....do ...	....do ...	1.00	35,300	.....do	.....	.....
552	43	8	....do ...	Outside.	....do ...	1.00	36,650	.....do	.....	.....
553	43	9	....do ...	....do ...	....do ...	1.00	35,350	.....do	.....	.....
554	43	3	Muzzle .	Inside ..	....do ...	1.00	36,150	.....do	7.3351	19.60
555	43	4	....do ...	Outside.	....do ...	1.00	33,600	.....do	7.3349	19.70
556	43	5	....do ...	....do ...	....do ...	1.00	35,900	.....do	7.3335	18.98

12-INCH B. L. RIFLED MORTARS.

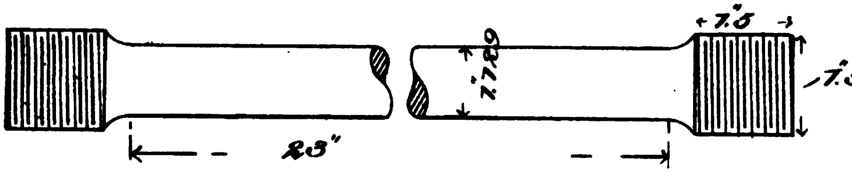
TABULATION OF COMPRESSION SPECIMENS FROM CAST-IRON BODIES.

No. of test.	Number of— Mortar.	Number of— Specimen.	Position in body.	Location of specimen.	Total length.	Sectional area.	Ultimate strength per square inch.	Manner of failure.	Specific gravity.	Hardness.
					Inches.	*Sq.inch.*	*Pounds.*			
1136	31	2	Breech..	Inside ..	10.5	1.00	59,880	Triple flexure, downward.	.....	.....
1137	31	10	....do ...	Radial ..	10.5	1.00	60,580	Triple flexure, upward.	.....	.....
1138	31	2	Muzzle .	Inside ..	10.5	1.00	66,180	Triple flexure, horizontally.	.....	.....
1127	33	2	Breech..	....do ...	10.5	1.00	61,000	Triple flexure, upward and sidewise.	.....	.....
1128	33	10	....do ...	Radial ..	10.5	1.00	60,860	Triple flexure, sidewise.	.....	.....
1129	33	2	Muzzle .	Inside ..	10.5	1.00	64,100	Triple flexure, upward.	.....	.....
1130	34	2	Breech..	....do ...	10.5	1.00	57,150	Triple flexure, downward.	.....	.....
1131	34	10	....do ...	Radial ..	10.5	1.00	52,900	Triple flexure, upward.	.....	.....
1132	34	2	Muzzle .	Inside ..	10.5	1.00	61,300	Triple flexure, sidewise and upward.	.....	.....
1133	37	2	Breech..	....do ...	10.5	1.00	61,800	Triple flexure, downward and sidewise.	.....	.....
1134	37	10	....do ...	Radial ..	10.5	1.00	60,800	Triple flexure, upward.	.....	.....
1135	37	2	Muzzle .	Inside ..	10.5	1.00	67,800	.....do	.....	.....
1139	38	2	Breech..	....do ...	10.5	1.00	59,420	.....do	.....	.....
1140	38	10	....do ...	Radial ..	10.5	1.00	58,760	Triple flexure, horizontally and upward.	.....	.....
1141	38	2	Muzzle .	Inside ..	10.5	1.00	64,710	Triple flexure, horizontally.	.....	.....
1142	39	2	Breech..	....do ...	10.5	1.00	61,980	Triple flexure, upward.	.....	.....
1143	39	10	....do ...	Radial ..	10.5	1.00	59,100	Triple flexure, sidewise.	.....	.....
1144	39	2	Muzzle .	Inside ..	10.5	1.00	67,600	Triple flexure, upward.	.....	.....
1145	40	2	Breech..	....do ...	10.5	1.00	61,680	.....do	.....	.....
1146	40	10	....do ...	Radial ..	10.5	1.00	61,600	.....do	.....	.....
1147	40	2	Muzzle .	Inside ..	10.5	1.00	67,420	Triple flexure, sidewise.	.....	.....
1148	41	2	Breech..	....do ...	10.5	1.00	61,250	Triple flexure, obliquely.	.....	.....
1149	41	10	....do ...	Radial ..	10.5	1.00	63,050	Triple flexure, upward.	.....	.....
1150	41	2	Muzzle .	Inside ..	10.5	1.00	65,450	Triple flexure, sidewise.	.....	.....
1151	42	2	Breech..	....do ...	10.5	1.00	63,550	Triple flexure, downward.	.....	.....
1152	42	10	....do ...	Radial ..	10.5	1.00	62,300	Triple flexure, sidewise.	.....	.....
1153	42	2	Muzzle .	Inside .	10.5	1.00	67,750	Triple flexure, upward.	.....	.....
1157	42	2	Breech..	....do ...	10.5	1.00	63,790	.....do	.....	.....
1158	42	10	....do ...	Radial ..	10.5	1.00	61,050	Triple flexure, sidewise.	.....	.....
1159	42	2	Muzzle .	Inside ..	10.5	1.00	68,280	.....do	.....	.....
1154	43	2	Breech..	....do ...	10.5	1.00	63,250	Triple flexure, upward.	.....	.....
1155	43	10	....do ...	Radial ..	10.5	1.00	62,450	Triple flexure, downward.	.....	.....
1156	43	2	Muzzle .	Inside ..	10.5	1.00	67,550	Triple flexure, sidewise.	.....	.....

12-inch B.L. Rifled Mortars

Forms of specimens

Tension



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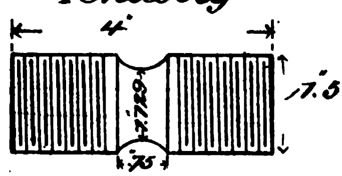

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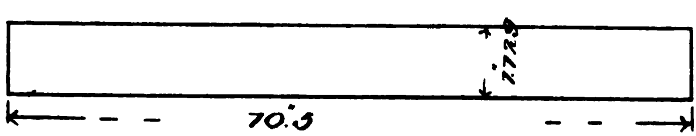
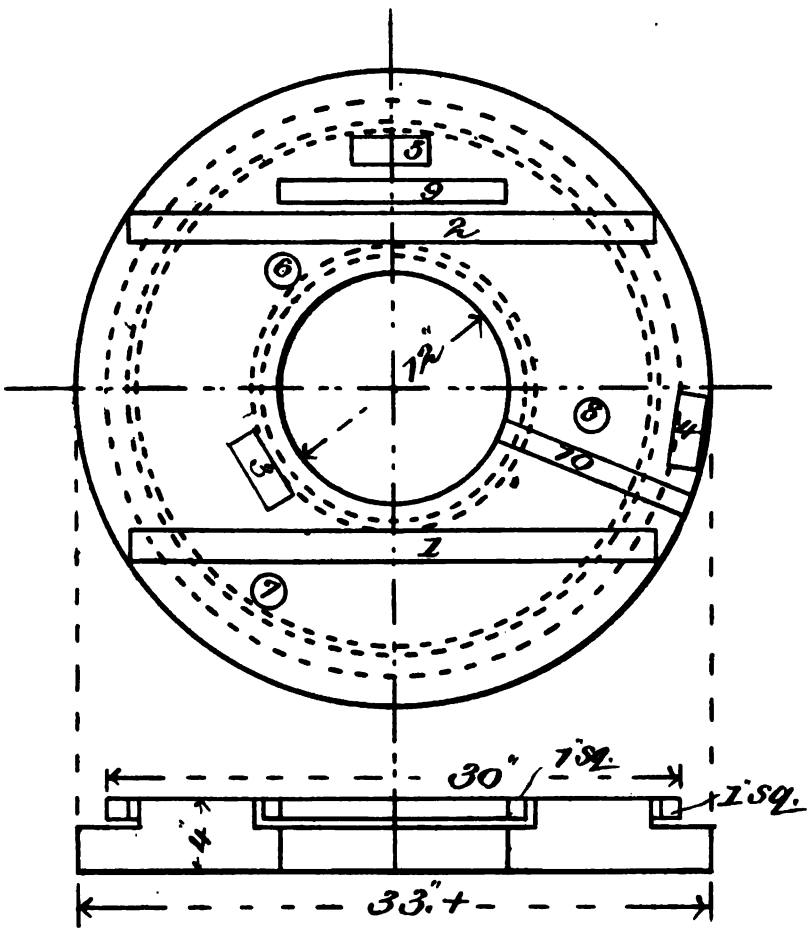


12-inch B.L. Rifled Mortars

Cast iron Bodies

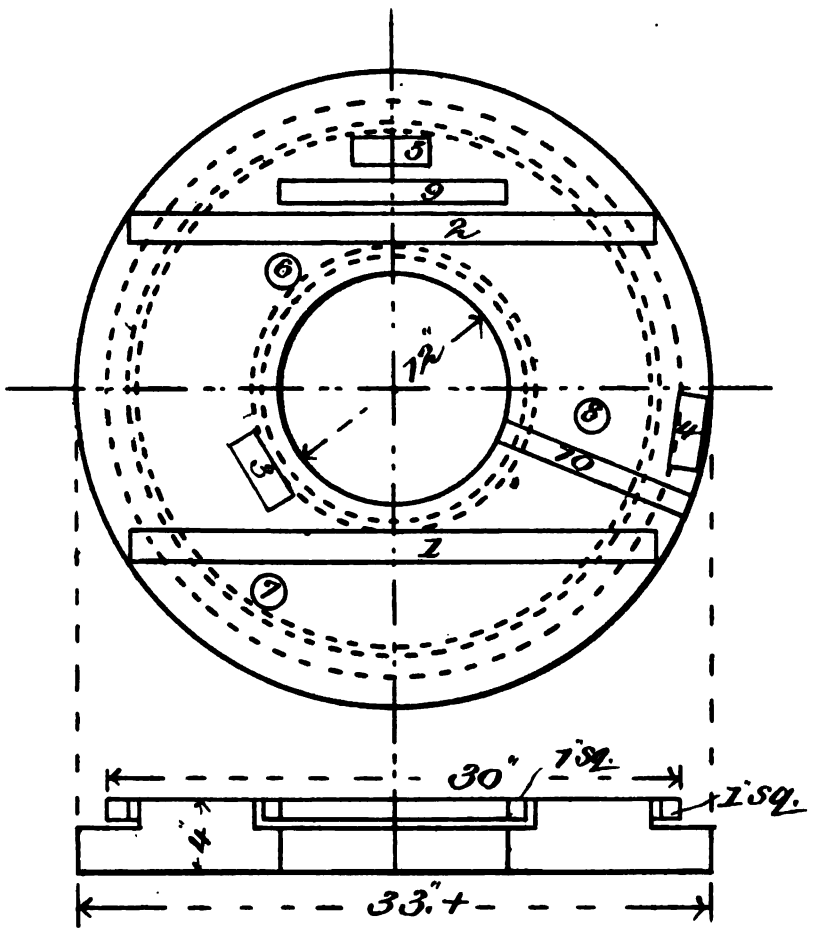
Breech end



12-inch B.L. Rifled Mortars

Cast iron Bodies

Breech end

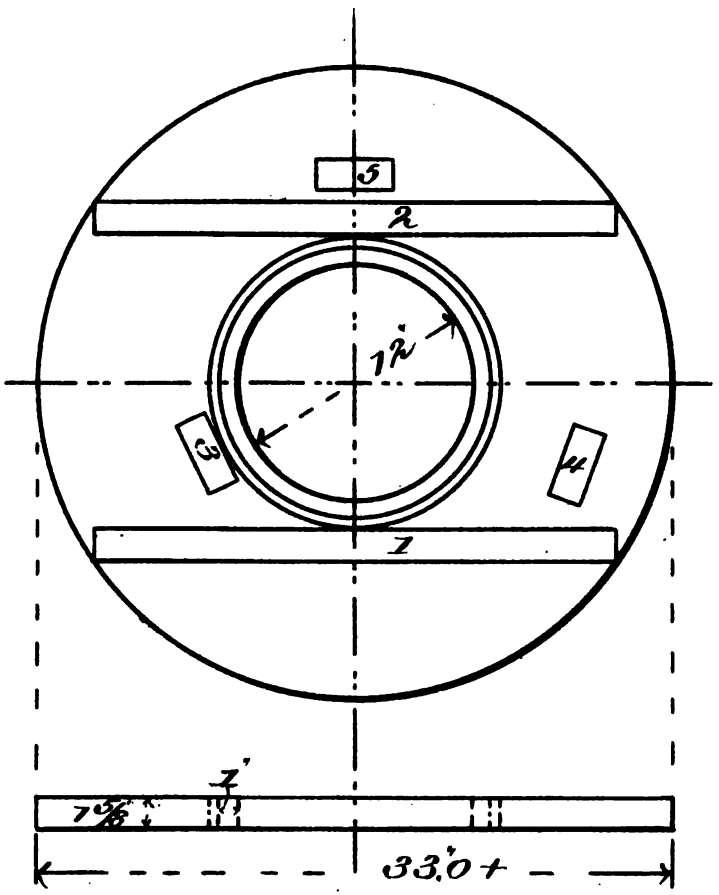


H Ex 92 53 3

12-inch B.L. Rifled Mortars

Cast iron Bodies

Muzzle end



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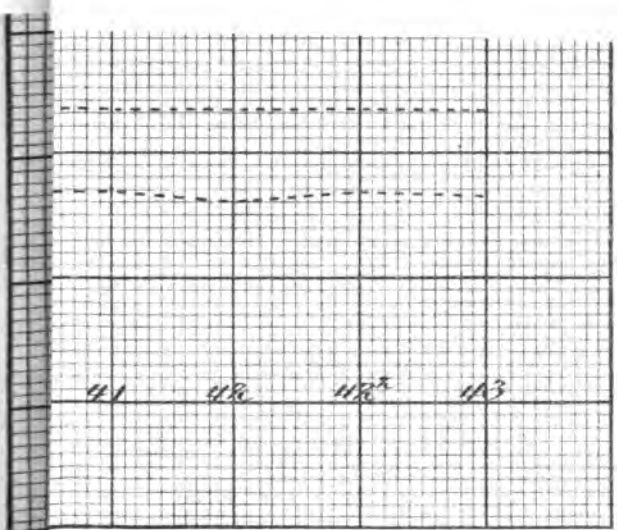
12-INCH B. L. RIFLE MORTARS.

Diagrams showing chemical composition, tensile strength, specific gravity, and hardness of cast-iron bodies.

The full lines in the diagrams represent results obtained with the long tension specimens.

The mean results of the grooved tenacity specimens are plotted in dotted lines, rejecting from the averages and indicating on the diagrams by dotted circles specimens which gave exceptionally high tensile strength.



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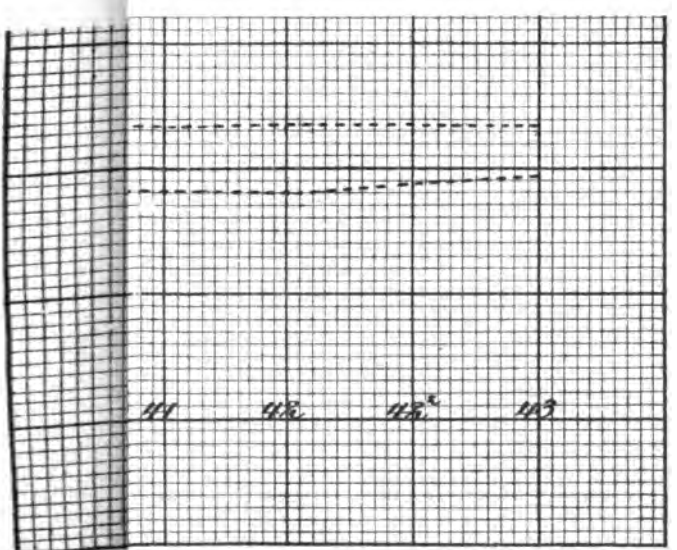


H Ex 92 53 3

RIFLE-BARREL STEEL.

No. 4921.

Marks, P B.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	
Total.	*Per square inch.*					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initi
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	0.	.....	
8,750	35,000	.001133	.000166	.....	.....	
10,000	40,000	.001300	.000167	0.	.....	
11,250	45,000	.001467	.000167	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	
11,750	47,000	.001600	.000067	.....	.....	Elast
12,000	48,000	.004367	.002767	.....	.....	
12,250	49,000	.005333	.000966	.....	.....	
12,500	50,000	.006033	.000700	.....	.....	
12,750	51,000	.006367	.000334	.....	.....	
13,000	52,000	.007000	.000633	.....	.....	
13,250	53,000	.007367	.000367	.....	.....	
13,500	54,000	.008000	.000633	.....	.....	
13,750	55,000	.008500	.000500	.....	.....	
14,000	56,000	.009167	.000667	.....	.....	
14,500	58,000	.010333	.C00166	.....	.....	
15,000	60,000	.011333	.001000	.....	.....	
15,500	62,000	.012833	.001500	.....	.....	
16,000	64,000	.014000	.001167	.....	.....	
16,500	66,000	.015333	.001333	.....	.....	
17,000	68,000	.016667	.001334	.....	.....	
17,500	70,000	.018000	.001333	.....	.....	
18,000	72,000	.019667	.001667	.....	.....	
18,500	74,000	.021500	.001833	.....	.....	
19,000	76,000	.023000	.001500	.....	.....	
19,500	78,000	.024667	.001667	.....	.....	
20,000	80,000	.026667	.002000	.....	.....	
20,500	82,000	.028667	.002000	.....	.....	
21,000	84,000	.031000	.002333	.....	.....	
21,500	86,000	.033333	.002333	.....	.....	
22,000	88,000	.036000	.002667	.....	.....	
22,500	90,000	.039000	.003000	.....	.....	
23,000	92,000	.043000	.004000	.....	.....	
23,500	94,000	.046667	.003667	.....	.....	
24,000	96,000	.051667	.005000	.....	.....	
24,500	98,000	.0600	.008333	.....	.....	
25,000	100,000	.0700	.0100	.....	.....	
25,500	102,000	.0833	.0133	.....	.....	
25,960	103,840	.....	.....	.....	.....	Tens

General summary.

Tensile strength per square inch of original section	
Elastic limit per square inch of original section	
Elongation per inch after rupture	
Elongation per inch under strain at elastic limit	
Reduction in diameter at point of rupture	
Reduction in area after rupture, per cent of original section	
Position of rupture	
Character of broken surface	granular, 60 per ce
Elongation of inch sections	

Chemical composition.

Total carbon	
Graphitic carbon	
Combined carbon	
Manganese	
Silicon	
Sulphur	
Phosphorus	
Copper	

No. 4922.

Mark H.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000533	.000266	.....	.....	
7,500	30,000	.000833	.000300	0.	.....	
8,750	35,000	.001033	.000200	.....	.....	
10,000	40,000	.001200	.000167	0.	.....	
10,250	41,000	.001267	.000067	.....	.....	Elastic limit.
10,500	42,000	.012667	.011400	.....	.....	
10,750	43,000	.018267	.005600	.....	.....	
11,000	44,000	.019000	.000733	.....	.....	
11,250	45,000	.020000	.001000	.....	.....	
11,500	46,000	.021400	.001400	.....	.....	
11,750	47,000	.023000	.001600	.....	.....	
12,000	48,000	.024500	.001500	.....	.....	
12,250	49,000	.025667	.001167	.....	.....	
12,500	50,000	.027667	.002000	.....	.....	
13,000	52,000	.031000	.003333	.....	.....	
13,500	54,000	.035300	.004300	.....	.....	
14,000	56,000	.040000	.004700	.....	.....	
14,500	58,000	.045333	.005333	.....	.....	
15,000	60,000	.052333	.007000	.....	.....	
15,500	62,000	.0600	.007667	.....	.....	
16,000	64,000	.0700	.0100	.....	.....	
16,500	66,000	.0833	.0133	.....	.....	
17,000	68,000	.1067	.0233	.....	.....	
17,500	70,000	.1467	.0400	.....	.....	
17,680	70,720	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	70,720
Elastic limit per square inch of original section	do...	41,000
Elongation per inch after rupture	inch..	.2800
Elongation per inch under strain at elastic limit	do...	.001267
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1″.77 from neck
Character of broken surface		silky
Elongation of inch sections		″.19, ″.46*, ″.19

Chemical composition.

	Per cent.
Total carbon	0.402
Graphitic carbon	0.012
Combined carbon	0.390
Manganese	0.151
Silicon	0.094
Sulphur	0.020
Phosphorus	0.025
Copper	0.000

No. 4923.

Marks, S J E X P.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000300	.000200			
5,000	20,000	.000667	.000367			
7,500	30,000	.001000	.000333	0.		
8,750	35,000	.001200	.000200			
10,000	40,000	.001333	.000133	0.		
11,250	45,000	.001500	.000167			
12,500	50,000	.001667	.000167			
13,750	55,000	.001833	.000166			
15,000	60,000	.002000	.000167			
16,250	65,000	.002167	.000167			
16,500	66,000	.002200	.000033			
16,750	67,000	.002267	.000067			
17,000	68,000	.002333	.000066			Elastic limit.
		.024733	.022400			
17,250	69,000	.025667	.000934			
17,500	70,000	.027000	.001333			
18,000	72,000	.029067	.002067			
18,500	74,000	.034000	.004933			
19,000	76,000	.037667	.003667			
19,500	78,000	.041667	.004000			
20,000	80,000	.0467	.005033			
20,500	82,000	.0533	.0066			
21,000	84,000	.0600	.0067			
21,500	86,000	.0700	.0100			
22,000	88,000	.0833	.0133			
22,500	90,000	.1100	.0267			
22,750	91,000	.1538	.0433			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds	91,000
Elastic limit per square inch of original section	do	68,000
Elongation per inch after rupture	inch	.2500
Elongation per inch under strain at elastic limit	do	.002333
Reduction in diameter at point of rupture	do	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		1". 4 from neck
Character of broken surface		fine silky
Elongation of inch sections		".14, ".38*, ".23

Chemical composition.

	Per cent.
Total carbon	0.287
Graphitic carbon	0.011
Combined carbon	0.276
Manganese	0.570
Silicon	0.159
Sulphur	0.045
Phosphorus	0.026
Copper	0.000

No. 4925.

Marks, A_1
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000300	.000200			
5,000	20,000	.000633	.000333			
7,500	30,000	.001000	.000367			
10,000	40,000	.001333	.000333	0.		
11,250	45,000	.001533	.000200			
12,500	50,000	.001700	.000167	.000033	.000033	
13,750	55,000	.001867	.000167			
15,000	60,000	.002033	.000166			
16,250	65,000	.002233	.000200			Elastic limit.
16,500	66,000	.006667	.004434			
16,750	67,000	.008833	.002166			
17,000	68,000	.009433	.000600			
17,250	69,000	.010000	.000567			
17,500	70,000	.011000	.001000			
18,000	72,000	.012333	.001333			
18,500	74,000	.013833	.001500			
19,000	76,000	.015500	.001167			
19,500	78,000	.017000	.001500			
20,000	80,000	.019167	.002167			
20,500	82,000	.021167	.002000			
21,000	84,000	.022667	.001500			
21,500	86,000	.024333	.001666			
22,000	88,000	.026667	.002334			
22,500	90,000	.029667	.003000			
23,000	92,000	.032000	.002333			
23,500	94,000	.034667	.002667			
24,000	96,000	.037333	.002666			
24,500	98,000	.041000	.003667			
25,000	100,000	.045000	.004000			
25,500	102,000	.0500	.0050			
26,000	104,000	.0567	.0067			
26,500	106,000	.0633	.0066			
27,000	108,000	.0767	.0134			
27,500	110,000	.1067	.0300			
27,520	110,080					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	110,080
Elastic limit per square inch of original section	do...	65,000
Elongation per inch after rupture	inch..	.1367
Elongation per inch under strain at elastic limit	do...	.002233
Reduction in diameter at point of rupture	do...	.054
Reduction in area after rupture, per cent of original section		18.3
Position of rupture		1″.37 from neck
Character of broken surface		granular, dull eccentric spot
Elongation of inch sections		″.13, ″.18*, ″.10
Composition combined carbon, per cent		0.290

No. 4926.

Marks, A_2.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.		
2,500	10,000	.000300	.000233			
5,000	20,000	.000633	.000333			
7,500	30,000	.000967	.000334			
10,000	40,000	.001300	.000333	0.		
11,250	45,000	.001467	.000167			
12,500	50,000	.001667	.000200	0.		
13,750	55,000	.001800	.000133			
15,000	60,000	.002000	.000200			
15,250	61,000	.002033	.000033			Elastic limit.
15,500	62,000	.013333	.011300			
15,750	63,000	.014333	.001000			
16,000	64,000	.015000	.000667			
16,250	65,000	.015833	.000833			
16,500	66,000	.017333	.001500			
17,000	68,000	.019000	.001667			
17,500	70,000	.020667	.001667			
18,000	72,000	.022000	.001333			
18,500	74,000	.026667	.004667			
19,000	76,000	.029667	.003000			
19,500	78,000	.032667	.003000			
20,000	80,000	.036000	.003333			
20,500	82,000	.039667	.003667			
21,000	84,000	.0433	.003633			
21,500	86,000	.0500	.0067			
22,000	88,000	.0567	.0067			
22,500	90,000	.0633	.0066			
23,000	92,000	.0767	.0134			
23,500	94,000	.0967	.0200			
24,000	96,000	.1600	.0633			Tensile strength.

General summary.

Tensile strength, per square inch of original section	pounds..	96,000
Elastic limit per square inch of original section	do...	61,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.7 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.15, ″.38*, ″.14
Composition combined carbon, per cent		0.320

No. 4937.

Marks, 4.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30.000	.000967	.000334	0.	.....	
10,000	40,000	.001300	.000333	0.	.....	
12,500	50,000	.001633	.000333	0.	.....	
15,000	60,000	.002000	.000367	0.	.....	
15,250	61,000	.002033	.000033	.....	.....	Elastic limit.
15,500	62,000	.012333	.010300	.....	.....	
15,750	63,000	.012833	.000500	.....	.....	
16,000	64,000	.013667	.000834	.....	.....	
16,250	65.000	.014267	.001000	.....	.....	
16,500	66,000	.015500	.001233	.....	.....	
16,750	67,000	.016667	.001167	.....	.....	
17,000	68,000	.017333	.000666	.....	.....	
17,250	69,000	.018133	.000800	.....	.....	
17,500	70,000	.019667	.001534	.....	.....	
18.000	72,000	.022000	.002333	.....	.....	
18,500	74,000	.024333	.002333	.....	.....	
19,000	76,000	.027000	.002667	.....	.....	
19,500	78,000	.029833	.002833	.....	.....	
20,000	80.000	.033000	.003167	.....	.....	
20,500	82,000	.0367	.0037	.....	.....	
21,000	84,000	.0400	.0033	.....	.....	
21,500	86,000	.0433	.0033	.....	.....	
22,000	88,000	.0500	.0067	.....	.....	
22,500	90,000	.0600	.0100	.....	.....	
23,000	92,000	.0667	.0067	.....	.....	
23,500	94,000	.0767	.0100	.....	.....	
24,000	96,000	.1000	.0233	.....	.....	
24,380	97,520	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	97,520
Elastic limit per square inch of original section	do...	61,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.184
Reduction in area after rupture, per cent of original section		54.6
Position of rupture		1″.3 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.30*, ″.27*, ″.12

No. 4938.

Marks, 5.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001333	.000366	0.	.....	
12,500	50,000	.001667	.000334	0.	.....	
14,000	56,000	.001867	.000200	.....	.....	
14,250	57,000	.001933	.000066	.....	.....	Elastic limit.
14,500	58,000	.007833	.005900	.....	.....	
14,750	59,000	.008033	.000200	.....	.....	
15,000	60,000	.008433	.000400	.....	.....	
15,500	62,000	.009667	.001234	.....	.....	
16,000	64,000	.010933	.001266	.....	.....	
16,500	66,000	.012333	.001400	.....	.....	
17,000	68,000	.014000	.001667	.....	.....	
17,500	70,000	.015333	.001333	.....	.....	
18,000	72,000	.016933	.001600	.....	.....	
18,500	74,000	.018567	.001634	.....	.....	
19,000	76,000	.020333	.001766	.....	.....	
19,500	78,000	.022167	.001834	.....	.....	
20,000	80,000	.023933	.001766	.....	.....	
20,500	82,000	.026000	.002067	.....	.....	
21,000	84,000	.028000	.002000	.....	.....	
21,500	86,000	.030667	.002667	.....	.....	
22,000	88,000	.033333	.002666	.....	.....	
22,500	90,000	.036000	.002667	.....	.....	
23,000	92,000	.0400	.0040	.....	.....	
23,500	94,000	.0433	.0033	.....	.....	
24,000	96,000	.0467	.0034	.....	.....	
24,500	98,000	.0533	.0066	.....	.....	
25,000	100,000	.0600	.0067	.....	.....	
25,500	102,000	.0700	.0100	.....	.....	
26,000	104,000	.0833	.0133	.....	.....	
26,220	104,880	.1233	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	104,880
Elastic limit per square inch of original section	do...	57,000
Elongation per inch after rupture	inch..	.1667
Elongation per inch under strain at elastic limit	do...	.001933
Reduction in diameter at point of rupture	do...	.074
Reduction in area after rupture, per cent of original section		24.6
Position of rupture		1″.6 from neck
Character of broken surface		granular at circumference, 50 per cent; silky at center, 50 per cent
Elongation of inch sections		″.12, ″.26*, ″.12

No. 4949.

Marks, 10.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000300	.000200			
5,000	20,000	.000633	.000333			
7,500	30,000	.001000	.000367			
10,000	40,000	.001333	.000333	0.		
11,250	45,000	.001500	.000167			
12,500	50,000	.001667	.000167			
13,750	55,000	.001867	.000200			
15,000	60,000	.002033	.000166	0.		
15,250	61,000	.002067	.000034			
15,500	62,000	.002133	.000066			
15,750	63,000	.002200	.000067			Elastic limit.
16,000	64,000	.002300	.000100			
16,250	65,000	.004000	.001700			
16,500	66,000	.006000	.002000			
16,750	67,000	.006600	.000600			
17,000	68,000	.007333	.000733			
17,250	69,000	.007833	.000500			
17,500	70,000	.008500	.000667			
18,000	72,000	.009667	.001167			
18,500	74,000	.010833	.001166			
19,000	76,000	.012067	.001234			
19,500	78,000	.013333	.001266			
20,000	80,000	.014667	.001334			
20,500	82,000	.016167	.001500			
21,000	84,000	.017500	.001333			
21,500	86,000	.019000	.001500			
22,000	88,000	.020333	.001333			
22,500	90,000	.021667	.001334			
23,000	92,000	.023333	.001666			
23,500	94,000	.024667	.001334			
24,000	96,000	.026400	.001733			
24,500	98,000	.028833	.002433			
25,000	100,000	.030667	.001834			
25,500	102,000	.033300	.002633			
26,000	104,000	.0367	.0034			
26,500	106,000	.0400	.0033			
27,000	108,000	.0433	.0033			
27,500	110,000	.0467	.0034			
28,000	112,000	.0500	.0033			
28,500	114,000	.0567	.0067			
29,000	116,000	.0667	.0100			
29,500	118,000	.0767	.0100			
30,000	120,000	.1067	.0300			
30,110	120,440					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	120,440
Elastic limit per square inch of original section	do...	63,000
Elongation per inch after rupture	inch..	.1267
Elongation per inch under strain at elastic limit	do...	.002200
Reduction in diameter at point of rupture	do...	.054
Reduction in area after rupture, per cent of original section		18.3
Position of rupture		″.95 from neck
Character of broken surface		granular, dull spot at center
Elongation of inch sections		″.14*, ″.14, ″.10

Chemical composition.

	Per cent.
Total carbon	0.482
Graphitic carbon	0.031
Combined carbon	0.451
Manganese	0.761
Silicon	0.124
Sulphur	0.145
Phosphorus	0.051
Copper	0.020

No. 4950.

Marks, 11.
Diameter, ".564."
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	0.	.....	
10,000	40,000	.001333	.000366	.....	.....	
11,250	45,000	.001533	.000200	.....	.....	
12,500	50,000	.001700	.000167	0.	.....	
13,750	55,000	.001833	.000133	.....	.....	
15,000	60,000	.002033	.000200	0.	.....	
15,250	61,000	.002067	.000034	.....	.....	
15,500	62,000	.002100	.000033	.....	.....	
15,750	63,000	.002167	.000067	.....	.....	
16,000	64,000	.002200	.000033	.....	.....	
16,250	65,000	.002233	.000033	.....	.....	
16,500	66,000	.002300	.000067	.....	.....	Elastic limit.
16,750	67,000	.009000	.006700	.....	.....	
17,000	68,000	.009600	.000600	.....	.....	
17,250	69,000	.010000	.000400	.....	.....	
17,500	70,000	.010667	.000667	.....	.....	
18,000	72,000	.012000	.001333	.....	.....	
18,500	74,000	.013500	.001500	.....	.....	
19,000	76,000	.015000	.001500	.....	.....	
19,500	78,000	.016667	.001667	.....	.....	
20,000	80,000	.018333	.001666	.....	.....	
20,500	82,000	.019833	.001500	.....	.....	
21,000	84,000	.021500	.001667	.....	.....	
21,500	86,000	.023333	.001833	.....	.....	
22,000	88,000	.025200	.001867	.....	.....	
22,500	90,000	.027333	.002133	.....	.....	
23,000	92,000	.029667	.002334	.....	.....	
23,500	94,000	.031667	.002000	.....	.....	
24,000	96,000	.034333	.002666	.....	.....	
24,500	98,000	.0367	.002367	.....	.....	
25,000	100,000	.0400	.0033	.....	.....	
25,500	102,000	.0433	.0033	.....	.....	
26,000	104,000	.0500	.0067	.....	.....	
26,500	106,000	.0567	.0067	.....	.....	
27,000	108,000	.0633	.0066	.....	.....	
27,500	110,000	.0733	.0100	.....	.....	
28,000	112,000	.0900	.0167	.....	.....	
28,260	113,040	.1267	.0367	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	113,040
Elastic limit per square inch of original section	do...	66,000
Elongation per inch after rupture	inch.	.1667
Elongation per inch under strain at elastic limit	do...	.002300
Reduction in diameter at point of rupture	do...	.074
Reduction in area after rupture, per cent of original section		24.6
Position of rupture		1".17 from neck
Character of broken surface		granular, 60 per cent; silky, 40 per cent
Elongation of inch sections		".14, ".19*, ".17*

No. 4951.

Marks, 12.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000324	0.	.....	
10,000	40,000	.001300	.000333	.....	.....	
11,250	45,000	.001467	.000167	.....	.....	
12,500	50,000	.001667	.000200	0.	.....	
13,750	55,000	.001833	.000166	.....	.....	
15,000	60,000	.002000	.000167	0.	.....	
15,250	61,000	.002067	.000067	.....	.....	Elastic limit.
15,500	62,000	.009333	.007266	.....	.....	
15,750	63,000	.010000	.000667	.....	.....	
16,000	64,000	.010500	.000500	.....	.....	
16,250	65,000	.011300	.000800	.....	.....	
16,500	66,000	.011767	.000467	.....	.....	
16,750	67,000	.012667	.000900	.....	.....	
17,000	68,000	.013333	.000666	.....	.....	
17,250	69,000	.014000	.000667	.....	.....	
17,500	70,000	.014667	.000667	.....	.....	
18,000	72,000	.016333	.001666	.....	.....	
18,500	74,000	.018000	.001667	.....	.....	
19,000	76,000	.019667	.001667	.....	.....	
19,500	78,000	.021333	.001666	.....	.....	
20,000	80,000	.023333	.002000	.....	.....	
20,500	82,000	.025500	.002167	.....	.....	
21,000	84,000	.027333	.001833	.....	.....	
21,500	86,000	.029767	.002434	.....	.....	
22,000	88,000	.032167	.002400	.....	.....	
22,500	90,000	.035000	.002833	.....	.....	
23,000	92,000	.037500	.002500	.....	.....	
23,500	94,000	.040667	.003167	.....	.....	
24,000	96,000	.044667	.004000	.....	.....	
24,500	98,000	.0500	.005333	.....	.....	
25,000	100,000	.0600	.0100	.....	.....	
25,500	102,000	.0667	.0067	.....	.....	
26,000	104,000	.0733	.0066	.....	.....	
26,500	106,000	.0900	.0167	.....	.....	
27,000	108,000	.1167	.0267	.....	.....	
27,040	108,160	.1400	.0233	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	108,160
Elastic limit per square inch of original section	do...	61,000
Elongation per inch after rupture	inch..	.2100
Elongation per inch under strain at elastic limit	do...	.002067
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.7 from neck
Character of broken surface		silky
Elongation of inch sections		″.13, ″.37*, ″.13

No. 4952.

Marks, 13.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	0.	.....	
10,000	40,000	.001300	.000333	.....	.....	
11,250	45,000	.001467	.000167	.....	.....	
12,500	50,000	.001667	.000200	0.	.....	
13,750	55,000	.001800	.000133	.....	.....	
15,000	60,000	.002000	.000200	0.	.....	
15,250	61,000	.002033	.000033	.....	.....	
15,500	62,000	.002067	.000034	.....	.....	
15,750	63,000	.002100	.000033	.....	.....	
16,000	64,000	.002133	.000033	.....	.....	
16,250	65,000	.002200	.000067	.....	.....	Elastic limit.
16,500	66,000	.002300	.000100	.....	.....	
16,750	67,000	.002967	.000667	.....	.....	
17,000	68,000	.006167	.003200	.....	.....	
17,250	69,000	.007667	.001500	.....	.....	
17,500	70,000	.008667	.001000	.....	.....	
18,000	72,000	.010833	.002166	.....	.....	
18,500	74,000	.012667	.001834	.....	.....	
19,000	76,000	.015000	.002333	.....	.....	
19,500	78,000	.017000	.002000	.....	.....	
20,000	80,000	.019333	.002333	.....	.....	
20,500	82,000	.021667	.002334	.....	.....	
21,000	84,000	.024333	.002666	.....	.....	
21,500	86,000	.027000	.002667	.....	.....	
22,000	88,000	.030333	.003333	.....	.....	
22,500	90,000	.033667	.003334	.....	.....	
23,000	92,000	.037667	.004000	.....	.....	
23,500	94,000	.042333	.004666	.....	.....	
24,000	96,000	.0500	.007667	.....	.....	
24,500	98,000	.0600	.0100	.....	.....	
25,000	100,000	.0700	.0100	.....	.....	
25,500	102,000	.1033	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	102,000
Elastic limit per square inch of original section	do...	65,000
Elongation per inch after rupture	inch..	.2233
Elongation per inch under strain at elastic limit	do...	.002200
Reduction in diameter at point of rupture	do...	.194
Reduction in area after rupture, per cent of original section		57.0
Position of rupture		1″.7 from neck
Character of broken surface		fine silky, serrated
Elongation of inch sections		″.13, ″.41⁴, ″.13

No. 4956.

Marks, 14.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	0.	.....	
10,000	40,000	.001367	.000367	.....	.....	
12,500	50,000	.001867	.000500	.000067	.0000.7	
12,750	51,000	.001933	.000066	.....	.....	Elastic limit.
13,000	52,000	.002200	.000267	.....	.....	
13,250	53,000	.006167	.003967	.....	.....	
13,500	54,000	.006733	.000566	.....	.....	
13,750	55,000	.007267	.000534	.....	.....	
14,000	56,000	.007933	.000666	.....	.....	
14,250	57,000	.008433	.000500	.....	.....	
14,500	58,000	.009033	.000600	.....	.....	
14,750	59,000	.009500	.000467	.....	.....	
15,000	60,000	.010333	.000833	.....	.....	
15,500	62,000	.011667	.001334	.....	.....	
16,000	64,000	.012833	.001166	.....	.....	
16,500	66,000	.014167	.001334	.....	.....	
17,000	68,000	.015667	.001500	.....	.....	
17,500	70,000	.017333	.001666	.....	.....	
18,000	72,000	.018667	.001334	.....	.....	
18,500	74,000	.020333	.001666	.....	.....	
19,000	76,000	.022000	.001667	.....	.....	
19,500	78,000	.023667	.001667	.....	.....	
20,000	80,000	.026000	.002333	.....	.....	
20,500	82,000	.028000	.002000	.....	.....	
21,000	84,000	.030000	.002000	.....	.....	
21,500	86,000	.032333	.002333	.....	.....	
22,000	88,000	.034667	.002334	.....	.....	
22,500	90,000	.037333	.002666	.....	.....	
23,000	92,000	.0400	.002667	.....	.....	
23,500	94,000	.0467	.0067	.....	.....	
24,000	96,000	.0533	.0066	.....	.....	
24,500	98,000	.0600	.0067	.....	.....	
25,000	100,000	.0667	.0067	.....	.....	
26,380	105,520	.1433	.0766	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	105,520
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.001933
Reduction in diameter at point of rupture	do...	.094
Reduction in area after rupture, per cent of original section		30.6
Position of rupture		1″.7 from neck
Character of broken surface		silky, interspersed with granular metal at the circumference
Elongation of inch sections		″.14, ″.29*, ″.16

Chemical composition.

	Per cent.
Total carbon	0.582
Graphitic carbon	0.022
Combined carbon	0.560
Manganese	0.547
Silicon	0.060
Sulphur	0.025
Phosphorus	0.060
Copper	0.035

No. 4958.

Marks, 15.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	0.	.....	
10,000	40,000	.001333	.000366	.....	.....	
11,250	45,000	.001500	.000167	.....	.....	
12,500	50,000	.001667	.000167	0.	.....	
13,000	52,000	.001733	.000066	.....	.....	
13,500	54,000	.001800	.000067	.....	.....	Elastic limit; load fell.
12,000	48,000	.005667	.003867	.....	.....	
		.011367	.005700	.....	.....	
12,250	49,000	.011600	.000233	.....	.....	
12,500	50,000	.011933	.000333	.....	.....	
12,750	51,000	.012600	.000667	.....	.....	
13,000	52,000	.012933	.000333	.....	.....	
13,250	53,000	.013400	.000467	.....	.....	
13,500	54,000	.014500	.001100	.....	.....	
13,750	55,000	.015000	.000500	.....	.....	
14,000	56,000	.015867	.000867	.....	.....	
14,500	58,000	.017667	.0018.0	.....	.....	
15,000	60,000	.019933	.002266	.....	.....	
15,500	62,000	.022333	.002400	.....	.....	
16,000	64,000	.024400	.002067	.....	.....	
16,500	66,000	.026667	.002267	.....	.....	
17,000	68,000	.029333	.002666	.....	.....	
17,500	70,000	.031667	.002334	.....	.....	
18,000	72,000	.034667	.003000	.....	.....	
18,500	74,000	.038000	.003333	.....	.....	
19,000	76,000	.041667	.003667	.....	.....	
19,500	78,000	.0467	.005033	.....	.....	
20,000	80,000	.0567	.0100	.....	.....	
20,500	82,000	.0633	.0066	.....	.....	
21,000	84,000	.0700	.0067	.....	.....	
21,500	86,000	.0800	.0100	.....	.....	
22,000	88,000	.1000	.0200	.....	.....	
22,450	89,800	.1600	.0600	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,800
Elastic limit per square inch of original section	do...	54,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		".7 from neck
Character of broken surface		silky
Elongation of inch sections		".17, ".35*, ".18

Chemical composition.

	Per cent.
Total carbon	0.510
Graphitic carbon	0.025
Combined carbon	0.485
Manganese	0.161
Silicon	0.136
Sulphur	0.019
Phosphorus	0.045
Copper	0.020

No. 4959.

Marks, 16.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	0.	.....	
10,000	40,000	.001333	.000366	.....	.....	
11,250	45,000	.001500	.000167	.....	.....	
12,500	50,000	.001667	.000167	0.	.....	
12,750	51,000	.001700	.000033	.....	.....	
13,000	52,060	.001733	.000033	.....	.....	
13,250	53,000	.001800	.000067	.....	.....	
13,500	54,000	.001867	.000067	.....	.....	Elastic limit.
13,750	55,000	.002400	.000533	.....	.....	
		.003133	.000733	.....	.....	
14,000	56,000	.003633	.000500	.....	.....	
14,250	57,000	.004033	.000400	.....	.....	
14,500	58,000	.004400	.000367	.....	.....	
14,750	59,000	.004667	.000267	.....	.....	
15,000	60,000	.005100	.000433	.....	.....	
15,500	62,000	.006000	.000900	.....	.....	
16,000	64,000	.006967	.000967	.....	.....	
16,500	66,000	.007667	.000700	.....	.....	
17,000	68,000	.008667	.001000	.....	.....	
17,500	70,000	.009667	.001000	.....	.....	
18,000	72,000	.010500	.000833	.....	.....	
18,500	74,000	.011667	.001167	.....	.....	
19,000	76,000	.012667	.001000	.....	.....	
19,500	78,000	.013667	.001000	.....	.....	
20,000	80,000	.014833	.001166	.....	.....	
20,500	82,000	.016000	.001167	.....	.....	
21,000	84,000	.017000	.001000	.....	.....	
21,500	86,000	.018333	.001333	.....	.....	
22,000	88,000	.019500	.001167	.....	.....	
22,500	90,000	.020833	.001333	.....	.....	
23,000	92,000	.022100	.001267	.....	.....	
23,500	94,000	.023500	.001400	.....	.....	
24,000	96,000	.025000	.001500	.....	.....	
24,500	98,000	.026667	.001667	.....	.....	
25,000	100,000	.028333	.001666	.....	.....	
26,000	104,000	.0333	.004967	.....	.....	
27,000	108,000	.0367	.0034	.....	.....	
28,000	112,000	.0433	.0066	.....	.....	
29,000	116,000	.0533	.0100	.....	.....	
30,000	120,000	.0700	.0167	.....	.....	
30,620	122,480	.1033	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	122,480
Elastic limit per square inch of original section	do...	54,000
Elongation per inch after rupture	inch..	.1067
Elongation per inch under strain at elastic limit	do...	.001867
Reduction in diameter at point of rupture	do...	.054
Reduction in area after rupture, per cent of original section		18.3
Position of rupture		1". 1 from neck
Character of broken surface.. granular radiating from a center punch mark defining the inch sections		
Elongation of inch sections		". 08, ". 13*, ". 11*

Chemical composition.

	Per cent.
Total carbon	0.852
Graphitic carbon	0.027
Combined carbon	0.825
Manganese	0.157
Silicon	0.140
Sulphur	0.018
Phosphorus	0.040
Copper	None

DUPLICATE OF NO. 4959.

No. 4996.

Marks, 16 D.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	0.	.....	
10,000	40,000	.001367	.000367	.....	.....	
11,250	45,000	.001667	.000300	0.	.....	
12,500	50,000	.001733	.000066	.000033	.000033	
12,750	51,000	.001833	.000100	.....	.....	Elastic limit.
13,000	52,000	.002833	.001000	.....	.....	
13,500	54,000	.004167	.001334	.....	.....	
14,000	56,000	.004967	.000800	.....	.....	
14,500	58,000	.005733	.000766	.....	.....	
15,000	60,000	.006667	.000934	.....	.....	
15,500	62,000	.007433	.000766	.....	.....	
16,000	64,000	.008367	.000934	.....	.....	
16,500	66,000	.009333	.000966	.....	.....	
17,000	68,000	.010333	.001000	.....	.....	
17,500	70,000	.011300	.000967	.....	.....	
18,000	72,000	.012400	.001100	.....	.....	
18,500	74,000	.013400	.001000	.....	.....	
19,000	76,000	.014500	.001100	.....	.....	
19,500	78,000	.015667	.001167	.....	.....	
20,000	80,000	.016733	.001066	.....	.....	
20,500	82,000	.017967	.001234	.....	.....	
21,000	84,000	.019100	.001133	.....	.....	
21,500	86,000	.020600	.001500	.....	.....	
22,000	88,000	.021933	.001333	.....	.....	
22,500	90,000	.023367	.001434	.....	.....	
23,000	92,000	.024833	.001466	.....	.....	
23,500	94,000	.026600	.001767	.....	.....	
24,000	96,000	.028100	.001500	.....	.....	
24,500	98,000	.030167	.002067	.....	.....	
25,000	100,000	.031667	.001500	.....	.....	
25,500	102,000	.0333	.001633	.....	.....	
26,000	104,000	.0367	.0034	.....	.....	
26,500	106,000	.0400	.0033	.....	.....	
27,000	108,000	.0433	.0033	.....	.....	
27,500	110,000	.0467	.0034	.....	.....	
28,000	112,000	.0533	.0066	.....	.....	
28,500	114,000	.0600	.0067	.....	.....	
29,000	116,000	.0667	.0067	.....	.....	
29,500	118,000	.0767	.0100	.....	.....	
29,800	119,200	.1067	.0300	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	119,200
Elastic limit per square inch of original section	do...	51,000
Elongation per inch after rupture	inch..	.1100
Elongation per inch under strain at elastic limit	do...	.001833
Reduction in diameter at point of rupture	do...	.064
Reduction in area after rupture, per cent of original section		21.4
Position of rupture		″.80 from neck
Character of broken surface		granular, dull spot at center
Elongation of inch sections		″.06, ″.10, ″.15*

No. 4960.

Marks, 17.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	0.	.....	
10,000	40,000	.001333	.000333	.....	.....	
11,250	45,000	.001500	.000167	.....	.....	
12,500	50,000	.001667	.000167	0.	.....	
12,750	51,000	.001700	.000033	.....	.....	
13,000	52,000	.001733	.000033	.....	.....	
13,250	53,000	.001800	.000067	.....	.....	Elastic limit.
13,500	54,000	.001933	.000133	.....	.....	
13,750	55,000	.002100	.000167	.....	.....	
14,000	56,000	.004000	.001900	.....	.....	
14,250	57,000	.004500	.000500	.....	.....	
14,500	58,000	.005000	.000500	.....	.....	
15,000	60,000	.005667	.000667	.....	.....	
15,500	62,000	.006933	.001266	.....	.....	
16,000	64,000	.007667	.000734	.....	.....	
16,500	66,000	.008500	.000833	.....	.....	
17,000	68,000	.009333	.000833	.....	.....	
17,500	70,000	.010333	.001000	.....	.....	
18,000	72,000	.011333	.001000	.....	.....	
18,500	74,000	.012333	.001000	.....	.....	
19,000	76,000	.013333	.001000	.....	.....	
19,500	78,000	.014333	.001000	.....	.....	
20,000	80,000	.015500	.001167	.....	.....	
20,500	82,000	.016667	.001167	.....	.....	
21,000	84,000	.017667	.001000	.....	.....	
21,500	86,000	.018933	.001266	.....	.....	
22,000	88,000	.020100	.001167	.....	.....	
22,500	90,000	.021400	.001300	.....	.....	
23,000	92,000	.023000	.001600	.....	.....	
24,000	96,000	.025833	.002833	.....	.....	
25,000	100,000	.029333	.003500	.....	.....	
26,000	104,000	.0333	.003967	.....	.....	
27,000	108,000	.0400	.0067	.....	.....	
28,000	112,000	.0467	.0067	.....	.....	
29,000	116,000	.0567	.0100	.....	.....	
30,000	120,000	.0767	.0200	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	120,000
Elastic limit per square inch of original section	do...	53,000
Elongation per inch after rupture	inch..	.0733
Elongation per inch under strain at elastic limit	do...	.001800
Reduction in diameter at point of rupture	do...	.024
Reduction in area after rupture, per cent of original section		8.4
Position of rupture		".2 from neck
Character of broken surface		granular, silky spot at center ".12 diameter
Elongation of inch sections		".07, ".07, ".08*

No. 4961.

Marks, 18.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	0.	.....	
10,000	40,000	.001333	.000333	.....	.....	
11,250	45,000	.001533	.000200	.....	.....	
11,500	46,000	.001567	.000034	.....	.....	
11,750	47,000	.001633	.000066	.....	.....	
12,000	48,000	.001733	.000100	.....	.....	Elastic limit.
12,250	49,000	.001967	.000234	.....	.....	
12,000	48,000	.008000	.006033	.....	.....	
12,250	49,000	.009667	.001667	.....	.....	
12,500	50,000	.012000	.002333	.....	.....	
12,750	51,000	.012667	.000667	.....	.....	
13,000	52,000	.013000	.000333	.....	.....	
13,250	53,000	.013667	.000667	.....	.....	
13,500	54,000	.014500	.000833	.....	.....	
14,000	56,000	.016333	.001833	.....	.....	
14,500	58,000	.018000	.001667	.....	.....	
15,000	60,000	.020000	.002000	.....	.....	
15,500	62,000	.022000	.002000	.....	.....	
16,000	64,000	.024333	.002333	.....	.....	
16,500	66,000	.026667	.002334	.....	.....	
17,000	68,000	.029333	.002666	.....	.....	
17,500	70,000	.032333	.003000	.....	.....	
18,000	72,000	.035333	.003000	.....	.....	
18,500	74,000	.038667	.003334	.....	.....	
19,000	76,000	.042667	.004000	.....	.....	
19,500	78,000	.047333	.004666	.....	.....	
20,000	80,000	.0567	.009367	.....	.....	
20,500	82,000	.0633	.0066	.....	.....	
21,000	84,000	.0700	.0067	.....	.....	
21,500	86,000	.0867	.0167	.....	.....	
22,000	88,000	.1033	.0166	.....	.....	
22,340	89,360	.1567	.0534	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	89,360
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001733
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1″.7 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.18, ″.35*, ″.17

DUPLICATE OF No. 4961.

No. 4997.

Marks, 18 D.
Diameter, ".564.
Sectional area, .25 square inch
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	0.	.....	
10,000	40,000	.001333	.000333	.....	.....	
11,250	45,000	.001500	.000167	0.	.....	
11,500	46,000	.001600	.000100	.....	.....	
11,750	47,000	.001633	.000033	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	
12,250	49,000	.001667	0.	.....	.....	
12,500	50,000	.001667	0.	.....	.....	Elastic limit.
12,750	51,000	.012367	.010700	.....	.....	
13,000	52,000	.012767	.000400	.....	.....	
13,250	53,000	.013367	.000600	.....	.....	
13,500	54,000	.014000	.000633	.....	.....	
13,750	55,000	.014767	.000767	.....	.....	
14,000	56,000	.015633	.000866	.....	.....	
14,500	58,000	.017300	.001667	.....	.....	
15,000	60,000	.019167	.001867	.....	.....	
15,500	62,000	.021333	.002166	.....	.....	
16,000	64,000	.023667	.002334	.....	.....	
16,500	66,000	.025700	.002033	.....	.....	
17,000	68,000	.028267	.002567	.....	.....	
17,500	70,000	.031067	.002800	.....	.....	
18,000	72,000	.034000	.002933	.....	.....	
18,500	74,000	.037500	.003500	.....	.....	
19,000	76,000	.041167	.003667	.....	.....	
19,500	78,000	.045500	.004333	.....	.....	
20,000	80,000	.051000	.005500	.....	.....	
20,500	82,000	.057833	.006833	.....	.....	
21,000	84,000	.065333	.007500	.....	.....	
21,500	86,000	.0767	.011367	.....	.....	
22,000	88,000	.0967	.0200	.....	.....	
22,500	90,000	.1233	.0266	.....	.....	
22,800	91,200	.1733	.0500	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	91,200
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.2367
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		1".68 from neck
Character of broken surface	granular, 60 per cent; silky, 40 per cent	
Elongation of inch sections		".18, ".34*, ".19

No. 4962.

Marks, 19.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.		
2,500	10,000	.000333	.000266			
5,000	20,000	.000667	.000334			
7,500	30,000	.001000	.000333	0.		
10,000	40,000	.001367	.000367			
11,250	45,000	.001533	.000166	0.		
12,500	50,000	.001700	.000167			
13,750	55,000	.001933	.000233			
15,000	60,000	.002067	.000134			
15,250	61,000	.002100	.000033			
15,500	62,000	.002167	.000067			
15,750	63,000	.002200	.000033			Elastic limit.
16,000	64,000	.002333	.000133			Load fell.
15,500	62,000	.004333	.002000			
250	1,000					Rested 1 hour.
15,500	62,000	.005667	.001334			
		.009000	.003333			
15,750	63,000	.010667	.001667			
16,000	64,000	.011133	.000466			
16,250	65,000	.011667	.000534			
16,500	66,000	.012333	.000666			
16,750	67,000	.013000	.000667			
17,000	68,000	.013833	.000833			
17,500	70,000	.015333	.001500			
18,000	72,000	.017000	.001667			
18,500	74,000	.018667	.001667			
19,000	76,000	.020500	.001833			
19,500	78,000	.022333	.001833			
20,000	80,000	.024333	.002000			
20,500	82,000	.026333	.002000			
21,000	84,000	.028000	.001667			
21,500	86,000	.031000	.003000			
22,000	88,000	.033333	.002333			
22,500	90,000	.036667	.003334			
23,000	92,000	.039333	.002666			
23,500	94,000	.042667	.003334			
24,000	96,000	.046667	.004000			
24,500	98,000	.0533	.006663			
25,000	100,000					Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	100,000
Elastic limit per square inch of original section	do...	63,000
Elongation per inch after rupture	inch..	.0533
Elongation per inch under strain at elastic limit	do...	.002200
Reduction in diameter at point of rupture	do...	.024
Reduction in area after rupture, per cent of original section		8.4
Position of rupture		".15 from neck
Character of broken surface		fine granular, radiating from a silky center
Elongation of inch sections		".05, ".05, ".06*

Chemical composition.

	Per cent.
Total carbon	0.297
Graphitic carbon	0.018
Combined carbon	0.279
Manganese	0.690
Silicon	0.040
Sulphur	0.028
Phosphorus	0.092
Copper	0.177

No. 4963.

Marks, 20.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	0.	.....	
10,000	40,000	.001333	.000333	.....	.....	
11,250	45,000	.001500	.000167	.....	.....	
12,500	50,000	.001667	.000167	0.	.....	
13,750	55,000	.001867	.000200	.....	.....	
15,000	60,000	.002033	.000166	0.	.....	
15,250	61,000	.002067	.000034	.....	.....	
15,500	62,000	.002100	.000033	.....	.....	Elastic limit; load fell.
14,750	59,000	.007167	.005067	.....	.....	
15,000	60,000	.009333	.002166	.....	.....	
15,250	61,000	.010333	.001000	.....	.....	
15,500	62,000	.011800	.001467	.....	.....	
15,750	63,000	.012367	.000567	.....	.....	
16,000	64,000	.013067	.000700	.....	.....	
16,500	66,000	.014667	.001600	.....	.....	
17,000	68,000	.016333	.001666	.....	.....	
17,500	70,000	.017667	.001334	.....	.....	
18,000	72,000	.019333	.001666	.....	.....	
18,500	74,000	.021333	.002000	.....	.....	
19,000	76,000	.023000	.001667	.....	.....	
19,500	78,000	.025000	.002000	.....	.....	
20,000	80,000	.027167	.002167	.....	.....	
20,500	82,000	.029667	.002500	.....	.....	
21,000	84,000	.031867	.002200	.....	.....	
21,500	86,000	.035000	.003133	.....	.....	
22,000	88,000	.037667	.002667	.....	.....	
22,500	90,000	.041000	.003333	.....	.....	
23,000	92,000	.044467	.003467	.....	.....	
23,500	94,000	.0500	.005533	.....	.....	
24,000	96,000	.0567	.0067	.....	.....	
24,500	98,000	.0633	.0066	.....	.....	
25,000	100,000	.0700	.0067	.....	.....	
25,500	102,000	.0867	.0067	.....	.....	
26,000	104,000	.1100	.0233	.....	.....	
26,140	104,560	.1400	.0300	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	104,560
Elastic limit per square inch of original section	do...	62,000
Elongation per inch after rupture	inch..	.1733
Elongation per inch under strain at elastic limit	do...	.002100
Reduction in diameter at point of rupture	do...	.094
Reduction in area after rupture, per cent of original section		30.6
Position of rupture		″.75 from neck
Character of broken surface		Silky center; granular at the circumference
Elongation of inch sections		″.11, ″.15, ″.26*

No. 4968.

Marks, 21.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001367	.000367	0.	.....	
11,250	45,000	.001533	.000166	.....	.....	
12,500	50,000	.001667	.000134	0.	.....	
13,750	55,000	.001833	.000166	.....	.....	
15,000	60,000	.002000	.000167	.....	.....	
16,250	65,000	.002233	.000233	.....	.....	
17,500	70,000	.002333	.000100	.....	.....	
18,750	75,000	.002533	.000200	.....	.....	
20,000	80,000	.002700	.000167	.....	.....	
21,250	85,000	.002900	.000200	.....	.....	
22,500	90,000	.003033	.000133	0.	.....	
23,750	95,000	.003233	.000200	.....	.....	
25,000	100,000	.003400	.000167	0.	.....	
26,250	105,000	.003567	.000167	.....	.....	
27,500	110,000	.003800	.000233	0.	.....	
28,750	115,000	.003967	.000167	.....	.....	
29,250	117,000	.004033	.000066	.....	.....	
29,500	118,000	.004133	.000100	.....	.....	
29,750	119,000	.004200	.000067	.....	.....	
30,000	120,000	.004233	.000033	.000200	.000200	Elastic limit.
30,250	121,000	.004333	.000100	.....	.....	
30,500	122,000	.004500	.000167	.....	.....	
30,750	123,000	.004600	.000100	.....	.....	
31,000	124,000	.004833	.000233	.....	.....	
31,250	125,000	.005000	.000167	.000667	.000467	
35,000	140,000	.0300	.0250	.....	.....	
36,820	147,280	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	**pounds..**	**147,280**
Elastic limit per square inch of original section	**do...**	**120,000**
Elongation per inch after rupture	**inch..**	**.0967**
Elongation per inch under strain at elastic limit	**do...**	**.004233**
Reduction in diameter at point of rupture	**do...**	**.114**
Reduction in area after rupture, per cent of original section		**36.4**
Position of rupture		**″.45 from neck**
Character of broken surface		**fine silky; cup shaped**
Elongation of inch sections		**″.21″, ″.04, ″.04**

Chemical composition.

	Per cent.
Total carbon	**0.483**
Graphitic carbon	**0.022**
Combined carbon	**0.461**
Manganese	**1.014**
Silicon	**0.125**
Sulphur	**0.080**
Phosphorus	**0.073**
Copper	**0.046**

No. 4969.

Marks, 21.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001367	.000367	0.	.....	
12,500	50,000	.001667	.000300	.....	.....	
15,000	60,000	.002033	.000366	0.	.....	
17,500	70,000	.002367	.000334	.....	.....	
20,000	80,000	.002700	.000333	0.	.....	
22,500	90,000	.003033	.000333	.....	.....	
25,000	100,000	.003400	.000367	0.	.....	
26,250	105,000	.003600	.000200	.....	.....	
27,500	110,000	.003733	.000133	0.	.....	
27,750	111,000	.003800	.000067	.....	.....	
28,000	112,000	.003867	.000067	.....	.....	
28,250	113,000	.003900	.000033	.....	.....	
28,500	114,000	.003967	.000067	.....	.....	
28,750	115,000	.004000	.000033	.....	.....	
29,000	116,000	.004033	.000033	.....	.....	
29,250	117,000	.004067	.000034	.....	.....	Elastic limit.
29,500	118,000	.004200	.000133	.....	.....	
29,750	119,000	.004300	.000100	.....	.....	
30,000	120,000	.004400	.000100	.000333	.000333	
30,250	121,000	.004767	.000367	.....	.....	
30,500	122,000	.005000	.000233	.....	.....	
30,750	123,000	.005300	.000300	.....	.....	
31,000	124,000	.005633	.000333	.....	.....	
31,250	125,000	.006433	.000800	.....	.....	
36,510	146,040	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	146,040
Elastic limit per square inch of original section	do...	117,000
Elongation per inch after rupture	inch..	.0967
Elongation per inch under strain at elastic limit	do...	.004067
Reduction in diameter at point of rupture	do...	.114
Reduction in area after rupture, per cent of original section		36.4
Position of rupture		".40 from neck
Character of broken surface		fine silky; cup shaped
Elongation of inch sections		".04, ".05, ".20*

No. 4974.

Marks, P B.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001367	.000367	0.	.....	
11,250	45,000	.001667	.000300	.....	.....	
12,500	50,000	.002033	.000366	.000300	.000300	Elastic limit.
12,750	51,000	.002467	.000434	.....	.....	
13,000	52,000	.003667	.001200	.....	.....	
13,250	53,000	.004700	.001033	.....	.....	
13,500	54,000	.005333	.000633	.....	.....	
13,750	55,000	.005967	.000634	.....	.....	
14,000	56,000	.006400	.000433	.....	.....	
14,250	57,000	.007000	.000600	.....	.....	
14,500	58,000	.007467	.000467	.....	.....	
14,750	59,000	.008033	.000566	.....	.....	
15,000	60,000	.008633	.000600	.....	.....	
15,500	62,000	.009767	.001134	.....	.....	
16,000	64,000	.011000	.001233	.....	.....	
16,500	66,000	.012167	.001167	.....	.....	
17,000	68,000	.013600	.001433	.....	.....	
17,500	70,000	.014700	.001100	.....	.....	
18,000	72,000	.016067	.001367	.....	.....	
18,500	74,000	.017400	.001333	.....	.....	
19,000	76,000	.019067	.001667	.....	.....	
19,500	78,000	.020700	.001633	.....	.....	
20,000	80,000	.022467	.001767	.....	.....	
20,500	82,000	.026667	.004200	.....	.....	
21,000	84,000	.026667	0.	.....	.....	
21,500	86,000	.0300	.003333	.....	.....	
22,000	88,000	.0333	.0033	.....	.....	
22,500	90,000	.0333	0.	.....	.....	
23,000	92,000	.0367	.0034	.....	.....	
23,500	94,000	.0400	.0033	.....	.....	
24,000	96,000	.0433	.0033	.....	.....	
24,500	98,000	.0467	.0034	.....	.....	
25,000	100,000	.0533	.0066	.....	.....	
25,500	102,000	.0600	.0067	.....	.....	
26,000	104,000	.0667	.0067	.....	.....	
26,500	106,000	.0800	.0133	.....	.....	
27,000	108,000	.1200	.0400	.....	.....	
27,100	108,400	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	108,400
Elastic limit per square inch of original section	do...	50,000
Elongation per inch after rupture	inch..	.1567
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.074
Reduction in area after rupture, per cent of original section		24.6
Position of rupture		1" from neck
Character of broken surface		granular, with dull center
Elongation of inch sections		".11, ".15, ".21*

No. 4982.

Marks, 12 A.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000267	.000200	.....	.....	
5,000	20,000	.000600	.000333	.....	.....	
7,500	30,000	.000933	.000333	0.	.....	
10,000	40,000	.001300	.000367	0.	.....	
11,250	45,000	.001433	.000133	.....	.....	
12,500	50,000	.001667	.000234	0.	.....	
12,750	51,000	.001667	0.	.....	.....	
13,000	52,000	.001700	.000033	.....	.....	
13,250	53,000	.001733	.000033	.....	.....	
13,500	54,000	.001733	0.	.....	.....	
13,750	55,000	.001800	.000067	.....	.....	
14,000	56,000	.001833	.000033	.....	.....	
14,250	57,000	.001900	.000067	.....	.....	
14,500	58,000	.001933	.000033	.....	.....	
14,750	59,000	.002000	.000067	.....	.....	
15,000	60,000	.002000	0.	.....	.....	
15,250	61,000	.002033	.000033	.....	.....	Elastic limit.
15,500	62,000	.006433	.004400	.....	.....	
15,750	63,000	.007100	.000667	.....	.....	
16,000	64,000	.007667	.000567	.....	.....	
16,500	66,000	.008933	.001266	.....	.....	
17,000	68,000	.010300	.001367	.....	.....	
17,500	70,000	.011667	.001367	.....	.....	
18,000	72,000	.013000	.001333	.....	.....	
18,500	74,000	.014500	.001500	.....	.....	
19,000	76,000	.015733	.001233	.....	.....	
19,500	78,000	.017267	.001534	.....	.....	
20,000	80,000	.018667	.001400	.....	.....	
20,500	82,000	.020333	.001666	.....	.....	
21,000	84,000	.022000	.001667	.....	.....	
21,500	86,000	.023667	.001667	.....	.....	
22,000	88,000	.025667	.002000	.....	.....	
22,500	90,000	.027667	.002000	.....	.....	
23,000	92,000	.029667	.002000	.....	.....	
23,500	94,000	.032167	.002500	.....	.....	
24,000	96,000	.034500	.002333	.....	.....	
24,500	98,000	.037600	.003100	.....	.....	
25,000	100,000	.040333	.002733	.....	.....	
26,000	104,000	.0467	.006367	.....	.....	
27,000	108,000	.0600	.0133	.....	.....	
28,000	112,000	.0733	.0133	.....	.....	
28,800	115,200	.1500	.0767	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	115,200
Elastic limit per square inch of original section	do...	61,000
Elongation per inch after rupture	inch..	.1933
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1".72 from neck
Character of broken surface		silky; slightly granular
Elongation of inch sections		".12, ".32*, ".14

Chemical composition.

	Per cent.
Total carbon	0.623
Graphitic carbon	0.022
Combined carbon	0.601
Silicon	0.291
Sulphur	0.042
Phosphorus	0.021

No. 4983.

STEEL FROM SWEDEN.

Marks, 22.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	0.	.....	
7,500	30,000	.000967	.000334	0.	.....	
10,000	40,000	.001300	.000333	0.	.....	
12,500	50,000	.001667	.000367	.....	.....	
13,750	55,000	.001833	.000166	.....	.....	
15,000	60,000	.002067	.000234	.....	.....	
15,250	61,000	.002067	0.	.....	.....	
15,500	62,000	.002133	.000066	.....	.....	
15,750	63,000	.002233	.000100	.....	.....	
16,000	64,000	.002300	.000067	.....	.....	
16,250	65,000	.002333	.000033	.....	.....	
16,500	66,000	.002333	0.	.....	.....	
16,750	67,000	.002367	.000034	.....	.....	
17,000	68,000	.002400	.000033	.....	.....	
17,250	69,000	.002500	.000100	.....	.....	
17,500	70,000	.002600	.000100	.....	.....	
17,750	71,000	.002633	.000033	.....	.....	
18,000	72,000	.002667	.000034	.....	.....	
18,250	73,000	.002733	.000066	.....	.....	
18,500	74,000	.002800	.000067	.....	.....	
18,750	75,000	.002933	.000133	.....	.....	
19,000	76,000	.003000	.000067	.....	.....	
19,250	77,000	.003033	.000033	.....	.....	
19,500	78,000	.003167	.000134	.....	.....	
19,750	79,000	.003300	.000133	.....	.....	
20,000	80,000	.003367	.000067	.....	.....	Elastic limit not well defined.
20,250	81,000	.003467	.000100	.....	.....	
20,500	82,000	.003633	.000166	.....	.....	
20,750	83,000	.003733	.000100	.....	.....	
21,000	84,000	.003967	.000234	.....	.....	
21,250	85,000	.004067	.000100	.....	.....	
21,500	86,000	.004367	.000300	.....	.....	
21,750	87,000	.004667	.000300	.....	.....	
22,000	88,000	.004933	.000266	.....	.....	
22,500	90,000	.005733	.000800	.....	.....	
23,000	92,000	.006733	.005433	.....	.....	
23,500	94,000	.008100	.001367	.....	.....	
24,000	96,000	.009800	.001700	.....	.....	
24,500	98,000	.011733	.001933	.....	.....	
25,000	100,000	.014000	.002267	.....	.....	
25,500	102,000	.016500	.002500	.....	.....	
28,300	113,200	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	113,200
Elastic limit per square inch of original section	do...	80,000
Elongation per inch after rupture	inch..	.1400
Elongation per inch under strain at elastic limit	do...	.003367
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1". 20 from neck
Character of broken surface		fine silky
Elongation of inch sections		".07, ".15*, ".20*

No. 4987.

STEEL ANNEALED BEFORE DRILLING.

Marks, 12 S.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001067	.000100	0.	.....	
10,000	40,000	.001300	.000233	0.	.....	
12,500	50,000	.001667	.000367	0.	.....	
12,750	51,000	.001667	0.	.....	.....	
13,000	52,000	.001667	0.	.....	.....	
13,250	53,000	.001700	.000033	.....	.....	
13,500	54,000	.001700	0.	.....	.....	
13,750	55,000	.001733	.000033	.....	.....	
14,000	56,000	.001767	.000034	.....	.....	Elastic limit.
14,250	57,000	.011667	.009900	.....	.....	
14,500	58,000	.012433	.000766	.....	.....	
14,750	59,000	.013167	.000734	.....	.....	
15,000	60,000	.013733	.000566	.....	.....	
15,250	61,000	.014667	.000934	.....	.....	
15,500	62,000	.015333	.000666	.....	.....	
15,750	63,000	.016067	.000734	.....	.....	
16,000	64,000	.016933	.000866	.....	.....	
16,250	65,000	.017700	.000767	.....	.....	
16,500	66,000	.018667	.000967	.....	.....	
16,750	67,000	.019500	.000833	.....	.....	
17,000	68,000	.020467	.000967	.....	.....	
17,250	69,000	.021333	.000866	.....	.....	
17,500	70,000	.022333	.001000	.....	.....	
18,000	72,000	.024267	.001934	.....	.....	
18,500	74,000	.026367	.002100	.....	.....	
19,000	76,000	.028500	.002133	.....	.....	
19,500	78,000	.031000	.002500	.....	.....	
20,000	80,000	.033333	.002333	.....	.....	
20,500	82,000	.036667	.003334	.....	.....	
21,000	84,000	.039667	.003000	.....	.....	
21,500	86,000	.043333	.003666	.....	.....	
22,000	88,000	.0467	.003367	.....	.....	
22,500	90,000	.0533	.0066	.....	.....	
23,000	92,000	.0600	.0067	.....	.....	
23,500	94,000	.0667	.0067	.....	.....	
24,000	96,000	.0733	.0066	.....	.....	
24,500	98,000	.0900	.0167	.....	.....	
25,000	100,000	.1067	.0167	.....	.....	
25,350	101,400	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	101,400
Elastic limit per square inch of original section	do...	56,000
Elongation per inch after rupture	inch..	.1967
Elongation per inch under strain at elastic limit	do...	.001767
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		1″.23 from neck
Character of broken surface		fine granular; dull spot at circumference
Elongation of inch sections		″.24, ″.23, ″.12

No. 5152.

Marks, 11 E.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
11,250	45,000	.001500	.000167	.....	.....	
12,500	50,000	.001667	.000167	0.	.....	
13,750	55,000	.001833	.000166	.....	.....	
15,000	60,000	.002000	.000167	0.	.....	
16,000	64,000	.002167	.000167	.....	.....	Elastic limit.
16,250	65,000	.010000	.007833	.....	.....	
16,500	66,000	.010667	.000667	.....	.....	
16,750	67,000	.011667	.001000	.....	.....	
17,000	68,000	.012333	.000666	.....	.....	
17,250	69,000	.013000	.000667	.....	.....	
17,500	70,000	.013833	.000833	.....	.....	
18,000	72,000	.015667	.001834	.....	.....	
18,500	74,000	.017000	.001333	.....	.....	
19,000	76,000	.018667	.001667	.....	.....	
19,500	78,000	.020333	.001666	.....	.....	
20,000	80,000	.022333	.002000	.....	.....	
20,500	82,000	.024667	.002334	.....	.....	
21,000	84,000	.026333	.001666	.....	.....	
21,500	86,000	.028333	.002000	.....	.....	
22,000	88,000	.031000	.002667	.....	.....	
22,500	90,000	.034000	.003000	.....	.....	
23,000	92,000	.036333	.002333	.....	.....	
23,500	94,000	.040333	.004000	.....	.....	
24,000	96,000	.044000	.003667	.....	.....	
24,500	98,000	.048000	.004000	.....	.....	
25,000	100,000	.053333	.005333	.....	.....	
25,500	102,000	.0600	.006667	.....	.....	
26,000	104,000	.0667	.0067	.....	.....	
26,500	106,000	.0800	.0133	.....	.....	
26,810	107,240	.1200	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	107,240
Elastic limit per square inch of original section	do...	64,000
Elongation per inch after rupture	inch..	.21000
Elongation per inch under strain at elastic limit	do...	.002167
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		1″.7 from neck
Character of broken surface		silky
Elongation of inch sections		″.13, ″.37*, ″.13

Chemical composition.

	Per cent.
Total carbon	0.416
Graphitic carbon	0.015
Combined carbon	0.401
Manganese	1.350
Silicon	0.080
Sulphur	0.100
Phosphorus	0.024
Copper	0.000

No. 5153.

Marks, 12 E.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001333	.000366	0.	.....	
11,250	45,000	.001500	.000167	.....	.....	
12,500	50,000	.001667	.000167	.....	.....	
13,750	55,000	.001833	.000166	.....	.....	
15,000	60,000	.002000	.000167	0.	.....	
15,250	61,000	.002033	.000033	.....	.....	
15,500	62,000	.002067	.000034	.....	.....	
15,750	63,000	.002100	.000033	.....	.....	
16,000	64,000	.002167	.000067	.....	.....	
16,250	65,000	.002233	.000066	.....	.....	Elastic limit.
16,500	66,000	.010333	.008100	.....	.....	
16,750	67,000	.010667	.000334	.....	.....	
17,000	68,000	.011167	.000500	.....	.....	
17,250	69,000	.011933	.000766	.....	.....	
17,500	70,000	.012833	.000900	.....	.....	
18,000	72,000	.014167	.001334	.....	.....	
18,500	74,000	.015667	.001500	.....	.....	
19,000	76,000	.017333	.001666	.....	.....	
19,500	78,000	.019000	.001667	.....	.....	
20,000	80,000	.020667	.001667	.....	.....	
20,500	82,000	.022333	.001666	.....	.....	
21,000	84,000	.024333	.002000	.....	.....	
21,500	86,000	.026333	.002000	.....	.....	
22,000	88,000	.028333	.002000	.....	.....	
22,500	90,000	.031000	.002667	.....	.....	
23,000	92,000	.033667	.002667	.....	.....	
23,500	94,000	.036333	.002666	.....	.....	
24,000	96,000	.039667	.003334	.....	.....	
24,500	98,000	.043000	.003333	.....	.....	
25,000	100,000	.047000	.004000	.....	.....	
25,500	102,000	.0533	.0063	.....	.....	
26,000	104,000	.0633	.0100	.....	.....	
26,500	106,000	.0700	.0067	.....	.....	
27,000	108,000	.0867	.0167	.....	.....	
27,320	109,280	.1167	.0300	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	109,280
Elastic limit per square inch of original section	do...	65,000
Elongation per inch after rupture	inch..	.1800
Elongation per inch under strain at elastic limit	do...	.002233
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		1″ from neck
Character of broken surface		silky
Elongation of inch sections		″.20*, ″.17, ″.11

No. 5156.

Marks, A. I.–X.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001333	.000333	0.	.....	
11,250	45,000	.001467	.000134	.....	.....	
12,500	50,000	.001700	.000233	.000033	.000033	
13,750	55,000	.001867	.000167	.....	.....	
15,000	60,000	.002033	.000166	.000033	0.	
16,250	65,000	.002233	.000200	.....	.....	
17,500	70,000	.002400	.000167	.000033	0.	Elastic limit.
17,750	71,000	.015000	.012600	.....	.....	
18,000	72,000	.016167	.001167	.....	.....	
18,250	73,000	.016733	.000566	.....	.....	
18,500	74,000	.018000	.001267	.....	.....	
18,750	75,000	.018833	.000833	.....	.....	
19,000	76,000	.019933	.001100	.....	.....	
19,500	78,000	.021667	.001734	.....	.....	
20,000	80,000	.024000	.002333	.....	.....	
20,500	82,000	.026333	.002333	.....	.....	
21,000	84,000	.029333	.003000	.....	.....	
21,500	86,000	.031667	.002334	.....	.....	
22,000	88,000	.034333	.002666	.....	.....	
22,500	90,000	.037667	.003334	.....	.....	
23,000	92,000	.0400	.002333	.....	.....	
23,500	94,000	.0433	.0033	.....	.....	
24,000	96,000	.0467	.0034	.....	.....	
24,500	98,000	.0533	.0066	.....	.....	
25,000	100,000	.0633	.0100	.....	.....	
25,500	102,000	.0733	.0100	.....	.....	
26,000	104,000	.0900	.0167	.....	.....	
26,500	106,000	.1300	.0400	.....	.....	
26,540	106,160	.1600	.0300	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	106,160
Elastic limit per square inch of original section	do...	70,000
Elongation per inch after rupture	inch..	.2133
Elongation per inch under strain at elastic limit	do...	.002400
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		at middle of stem
Character of broken surface		fine silky
Elongation of inch sections		″.14, ″.36, ″.14

No. 5157.

Marks, A. I. 35.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001367	.000367	0.	.....	
11,250	45,000	.001567	.000200	.....	.....	
12,500	50,000	.001733	.000166	0.	.....	
13,750	55,000	.001933	.000200	.....	.....	
15,000	60,000	.002100	.000167	0.	.....	
15,250	61,000	.002167	.000067	.....	.....	Elastic limit.
15,500	62,000	.013400	.011233	.....	.....	
15,750	63,000	.014667	.001267	.....	.....	
16,000	64,000	.015667	.001000	.....	.....	
16,250	65,000	.016400	.000733	.....	.....	
16,500	66,000	.017333	.000933	.....	.....	
16,750	67,000	.018333	.001000	.....	.....	
17,000	68,000	.019667	.001334	.....	.....	
17,500	70,000	.022000	.002333	.....	.....	
18,000	72,000	.024067	.002067	.....	.....	
18,500	74,000	.026667	.002600	.....	.....	
19,000	76,000	.029000	.002333	.....	.....	
19,500	78,000	.032000	.003000	.....	.....	
20,000	80,000	.035333	.003333	.....	.....	
20,500	82,000	.039000	.003667	.....	.....	
21,000	84,000	.043000	.004000	.....	.....	
21,500	86,000	.0467	.0037	.....	.....	
22,000	88,000	.0567	.0100	.....	.....	
22,500	90,000	.0633	.0066	.....	.....	
23,000	92,000	.0700	.0067	.....	.....	
23,500	94,000	.0833	.0133	.....	.....	
24,000	96,000	.1133	.0300	.....	.....	
24,090	96,360	.1400	.0267	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	96,360
Elastic limit per square inch of original section	do...	61,000
Elongation per inch after rupture	inch..	.2467
Elongation per inch under strain at elastic limit	do...	.002167
Reduction in diameter at point of rupture	do...	.204
Reduction in area after rupture, per cent of original section		59.3
Position of rupture		at middle of stem
Character of broken surface		fine silky
Elongation of inch sections		″.15, ″.45*, ″.14

No. 5171.

NICKEL STEEL.

Marks, 24—1.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000300	.000200			
5,000	20,000	.000633	.000333			
7,500	30,000	.000967	.000334	0.		
8,750	35,000	.001167	.000200			
10,000	40,000	.001333	.000166			
11,250	45,000	.001500	.000167			
12,500	50.000	.001667	.000167	0.		
13,750	55,000	.001833	.000166			
15,000	60,000	.002000	.000167	0.		
16,250	65,000	.002200	.000200			
17,500	70,000	.002333	.000133	0.		
18,750	75,000	.002533	.000200			
20,000	80,000	.002700	.000167			
21,250	85.000	.002900	.000200			
22,500	90,000	.003067	.000167			
23,750	95.000	.003267	.000200			
25,000	100,000	.003433	.000166			
26,250	105,000	.003833	.000200			Elastic limit; load fell.
25,500	102,000	.007333	.003700			
		.011333	.004000			
25,750	103,000	.013833	.002500			
26,000	104,000	.022000	.008167			
26,250	105,000	.025333	.003333			
26,500	106,000	.026667	.001334			
26,750	107,000	.029667	.003000			
27,000	108,000	.031667	.002000			
27,500	110,000	.038000	.006333			
28,000	112.000	.044333	.006333			
28,500	114,000	.0567	.012367			
29,000	116,000	.0667	.0100			
29,500	118,000	.1067	.0400			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	118,000
Elastic limit per square inch of original section	do...	105,000
Elongation per inch after rupture	inch..	.2033
Elongation per inch under strain at elastic limit	do...	.003633
Reduction in diameter at point of rupture	do...	.224
Reduction in area after rupture, per cent of original section		63.7
Position of rupture		1″.3 from neck
Character of broken surface		fine silky, with deep radial serrations
Elongation of inch sections		″.30*, ″.22*, ″.09

Chemical composition.

	Per cent.
Total carbon	0.338
Graphitic carbon	0.015
Combined carbon	0.323
Manganese	0.422
Silicon	0.103
Sulphur	0.040
Phosphorus	0.028
Copper	0.000

No. 5172.

NICKEL STEEL.

Marks, 24–2.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001333	.000366	0.	.....	
12,500	50,000	.001667	.000334	.....	.....	
15,000	60,000	.002000	.000333	0.	.....	
16,250	65,000	.002200	.000200	.....	.....	
17,500	70,000	.002367	.000167	.....	.....	
18,750	75,000	.002567	.000200	.....	.....	
20,000	80,000	.002733	.000166	0.	.....	
21,250	85,000	.002900	.000167	.....	.....	
22,500	90,000	.003067	.000167	.....	.....	
23,750	95,000	.003267	.000200	.....	.....	
25,000	100,000	.003433	.000166	.....	.....	
26,250	105,000	.003633	.000200	.....	.....	Elastic limit; load fell.
25,000	100,000	.006167	.002534	.....	.....	
		.012733	.006566	.....	.....	
25,250	101,000	.022000	.009267	.....	.....	
25,500	102,000	.023333	.001333	.....	.....	
25,750	103,000	.025333	.002000	.....	.....	
26,000	104,000	.026833	.001500	.....	.....	
26,250	105,000	.029333	.002500	.....	.....	
26,500	106,000	.032500	.003167	.....	.....	
26,750	107,000	.035000	.002500	.....	.....	
27,000	108,000	.038333	.003333	.....	.....	
27,500	110,000	.045667	.007334	.....	.....	
28,000	112,000	.054333	.008666	.....	.....	
28,500	114,000	.0667	.012367	.....	.....	
28,920	115,680	.1000	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	115,680
Elastic limit per square inch of original section	do...	105,000
Elongation per inch after rupture	inch..	.2000
Elongation per inch under strain at elastic limit	do...	.003633
Reduction in diameter at point of rupture	do...	.214
Reduction in area after rupture, per cent of original section		61.5
Position of rupture		1″.2 from neck
Character of broken surface		fine silky, with deep radial serrations
Elongation of inch sections		″.09, ″.26*, ″.23*

No. 5173.

WOOD ANNEALED.

Marks, S. 12–1.
Diameter, ″.505.
Sectional area, 20 square inch.
Gauged length, 1″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
6,000	30,000	.0009	.0009	0.	.....	
8,000	40,000	.0012	.0003	0.	.....	
10,000	50,000	.0016	.0004	.....	.....	
12,000	60,000	.0019	.0003	0.	.....	
14,000	70,000	.0023	.0004	.....	.....	
16,000	80,000	.0027	.0004	0.	.....	
18,000	90,000	.0030	.0003	0.	.....	
20,000	100,000	.0034	.0004	0.	.....	
20,800	104,000	.0039	.0005	.....	.....	Elastic limit.
21,000	105,000	.0045	.0006	.....	.....	
21,200	106,000	.0048	.0003	.....	.....	
21,400	107,000	.0051	.0003	.....	.....	
21,600	108,000	.0060	.0009	.....	.....	
21,800	109,000	.0070	.0010	.....	.....	
22,000	110,000	.0096	.0026	.....	.....	
22,400	112,000	.0106	.0010	.....	.....	
22,800	114,000	.0130	.0024	.....	.....	
24,000	120,000	.02	.007	.....	.....	
25,000	125,000	.03	.01	.....	.....	
26,000	130,000	.04	.01	.....	.....	
27,000	135,000	.07	.03	.....	.....	
27,150	135,750	.09	.02	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	135,750
Elastic limit per square inch of original section	do...	104,000
Elongation per inch after rupture	inch..	.23
Elongation per inch under strain at elastic limit	do...	.0039
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Character of broken surface		fine silky, with fine radial serrations

Chemical composition.

	Per cent.
Total carbon	0.418
Graphitic carbon	0.018
Combined carbon	0.400
Manganese	0.748
Silicon	0.296
Sulphur	0.050
Phosphorus	0.018
Copper	0.000

No. 5174.

WOOD ANNEALED.

Marks, S 12–4.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 1″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
2,000	10,000	.0003	.0003	.....	.....	
4,000	20,000	.0007	.0004	.....	.....	
6,000	30,000	.0010	.0003	.....	.....	
8,000	40,000	.0014	.0004	.....	.....	
10,000	50,000	.0017	.0003	.....	.....	
12,000	60,000	.0020	.0003	0.	.....	
14,000	70,000	.0024	.0004	.....	.....	
16,000	80,000	.0027	.0003	.....	.....	
18,000	90,000	.0030	.0003	0.	.....	
20,000	100,000	.0034	.0004	0.	.....	
21,000	105,000	.0037	.0003	.....	.....	
21,200	106,000	.0038	.0001	.....	.....	
21,400	107,000	.0039	.0001	.....	.....	Elastic limit.
21,600	108,000	.0054	.0015	.....	.....	
21,800	109,000	.0072	.0018	.....	.....	
22,000	110,000	.0078	.0006	.....	.....	
22,200	111,000	.0092	.0014	.....	.....	
22,400	112,000	.0112	.0020	.....	.....	
22,800	114,000	.0154	.0042	.....	.....	
23,200	116,000	.0185	.0031	.....	.....	
23,600	118,000	.0220	.0035	.....	.....	
24,000	120,000	.0268	.0048	.....	.....	
25,000	125,000	.03	.0032	.....	.....	
26,000	130,000	.05	.02	.....	.....	
27,000	135,000	.07	.02	.....	.....	
27,170	135,850	.11	.04	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	135,850
Elastic limit per square inch of original section	do...	107,000
Elongation per inch after rupture	inch..	.28
Elongation per inch under strain at elastic limit	do...	.0039
Reduction in diameter at point of rupture	do...	.135
Reduction in area after rupture, per cent of original section		46.2
Character of broken surface		fine silky, with fine radial serrations

No. 5192.

Marks, 25 No. 1.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.			
1,250	5,000	.000100	.000100	0.	0.	Initial load.
2,500	10,000	.000300	.000200	0.	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001367	.000367	0.	.....	
11,250	45,000	.001533	.000166	0.	.....	
12,500	50,000	.001733	.000200	.....	.....	
13,750	55,000	.001900	.000167	0.	.....	
15,000	60,000	.002100	.000100	.000033	.000033	
15,500	62,000	.002167	.000067	.000033	0.	
16,000	64,000	.002267	.000100	.....	.....	Elastic limit.
		.010333	.008066	.....	.....	
16,250	65,000	.010667	.000334	.....	.....	
16,500	66,000	.010933	.000266	.....	.....	
16,750	67,000	.011333	.000400	.....	.....	
17,000	68,000	.012000	.000667	.....	.....	
17,250	69,000	.012767	.000767	.....	.....	
17,500	70,000	.013700	.000933	.....	.....	
18,000	72,000	.015333	.001633	.....	.....	
18,500	74,000	.017000	.001667	.....	.....	
19,000	76,000	.018700	.001700	.....	.....	
19,500	78,000	.020400	.001700	.....	.....	
20,000	80,000	.022400	.002000	.....	.....	
21,000	84,000	.026667	.004267	.....	.....	
22,000	88,000	.031333	.004666	.....	.....	
23,000	92,000	.037000	.005667	.....	.....	
24,000	96,000	.0430	.0060	.....	.....	
25,000	100,000	.0530	.0100	.....	.....	
26,000	104,000	.0630	.0100	.....	.....	
27,000	108,000	.0900	.0270	.....	.....	
27,710	110,840	.1333	.0433	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	110,840
Elastic limit per square inch of original section	do...	64,000
Elongation per inch after rupture	inch..	.1733
Elongation per inch under strain at elastic limit	do...	.002267
Reduction in diameter at point of rupture	do...	.084
Reduction in area after rupture, per cent of original section		27.6
Position of rupture		at middle of stem
Character of broken surface		fine granular, radiating from a silky center
Elongation of inch sections		".13, ".26*, ".13

TABULATION OF TENSION SPECIMENS FROM RIFLE-BARREL STEEL.

No. of test.	Marks on specimen.	Diameter.	Sectional area.	Elastic limit. Total.	Elastic limit. Per sq. in.	Ultimate strength. Total.	Ultimate strength. Per sq. in.	Elongation in 3 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.
		Inch.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Inch.*	*Per ct.*	*Inch. Sq. in.*	*Per ct.*		" " "
4921	P B.....	.564	.25	11,750	47,000	25,960	103,840	.50	16.7	Diam., .48 = .181	27.6	Granular 60 per cent, silky 40 per cent.	.14, .24*, .12
4922	H.....	.564	.25	10,250	41,000	17,680	70,720	.84	28.0	Diam., .40 = .126	49.7	Silky	.19, .46*, .19
4923	SJEXP	.564	.25	17,000	68,000	22,750	91,000	.75	25.0	Diam., .38 = .113	54.6	Fine silky	.14, .38*, .23
4925	A_1.....	.564	.25	16,250	65,000	27,520	110,080	.41	13.7	Diam., .51 = .204	18.3	Granular, dull eccentric spot	.13, .18*, .10
4926	A_2.....	.564	.25	15,250	61,000	24,000	96,000	.67	22.3	Diam., .42 = .138	44.6	Fine silky	.15, .38*, .14
4937	4.....	.564	.25	15,250	61,000	24,380	97,520	.69	23.0	Diam., .38 = .113	54.6	.....do	.30*, .27*, .12
4938	5.....	.564	.25	14,250	57,000	26,220	104,880	.50	16.7	Diam., .49 = .189	24.6	Granular 50 per cent, silky center 50 per cent.	.12, .26*, .12
4949	10.....	.564	.25	15,750	63,000	30,110	120,440	.38	12.7	Diam., .51 = .204	18.3	Granular, dull spot at center	.14*, .14, .10
4950	11.....	.564	.25	16,500	66,000	28,260	113,040	.50	16.7	Diam., .49 = .189	24.6	Granular 60 per cent, silky 40 per cent.	.14, .19*, .17*
4951	12.....	.564	.25	15,250	61,000	27,040	108,160	.63	21.0	Diam., .42 = .144	44.6	Silky	.13, .37*, .13
4952	13.....	.564	.25	16,250	65,000	25,500	102,000	.67	22.3	Diam., .37 = .108	57.0	Fine silky, serrated	.13, .41*, .13
4956	14.....	.564	.25	12,750	51,000	26,380	105,520	.59	19.7	Diam., .47 = .173	30.6	Silky, granular at circumference	.14, .29*, .16
4958	15.....	.564	.25	13,500	54,000	22,450	89,800	.70	23.3	Diam., .44 = .152	39.2	Silky	.17, .35*, .18
4959	16.....	.564	.25	13,500	54,000	30,620	122,480	.32	10.7	Diam., .51 = .204	18.3	Granular, radiating from center punch mark defining inch sections.	.08, .13*, .11
4996	16 D....	.564	.25	12,750	51,000	29,800	119,200	.33	11.0	Diam., .50 = .196	21.4	Granular, dull spot at center	.08, .10, .15*
4960	17.....	.564	.25	13,250	53,000	30,000	120,000	.22	7.3	Diam., .54 = .229	8.4	Granular, silky spot at center	.07, .07, .08*
4961	18.....	.564	.25	12,000	48,000	22,340	89,360	.70	23.3	Diam., .44 = .152	39.2	Fine silky	.18, .35*, .12
4997	18 D....	.564	.25	12,500	50,000	22,800	91,200	.71	23.7	Diam., .45 = .159	36.4	Granular 60 per cent, silky 40 per cent.	.18, .34*, .19
4962	19.....	.564	.25	15,750	63,000	25,000	100,000	.16	5.3	Diam., .54 = .229	8.4	Fine granular, radiating from silky center.	.05, .05, .06*
4963	20.....	.564	.25	15,500	62,000	26,140	104,560	.52	17.3	Diam., .47 = .173	30.6	Silky center, granular at circumference.	.11, .15, .26*
4968	21.....	.564	.25	30,000	120,000	36,820	147,280	.29	9.7	Diam., .45 = .159	36.4	Fine silky; cup-shaped	.21*, .04, .04
4969	21.....	.564	.25	29,250	117,000	36,510	146,040	.29	9.7	Diam., .45 = .159	36.4	.....do	.04, .05, .20*
4974	P. B....	.564	.25	12,500	50,000	27,100	108,400	.47	15.7	Diam., .49 = .189	24.6	Granular, dull center	.11, .15, .21*
4982	12 A....	.564	.25	15,250	61,000	28,800	115,200	.58	19.3	Diam., .44 = .152	39.2	Silky, slightly granular	.12, .32*, .14
4983	22.....	.564	.25	20,000	80,000	28,300	113,200	.42	14.0	Diam., .43 = .145	41.9	Fine silky	.07, .15*, .20*
4987	12 S.....	.564	.25	14,000	56,000	25,350	101,400	.59	19.7	Diam., .46 = .166	33.5	Fine granular, dull spot at circumference.	.24*, .23, .12
5152	11 E....	.564	.25	16,000	64,000	26,810	107,240	.63	21.0	Diam., .41 = .132	47.2	Silky	.13, .37*, .13
5153	12 E....	.564	.25	16,250	65,000	27,320	109,280	.54	18.0	Diam., .44 = .152	39.2	.....do	.26*, .17, .11
5156	A. 1.-X.	.564	.25	17,500	71,000	26,540	106,160	.64	21.3	Diam., .42 = .138	44.6	Fine silky	.14, .36*, .14
5157	A I. 35..	.564	.25	15,250	61,000	24,090	96,360	.74	24.7	Diam., .36 = .102	59.3	.....do	.15, .45*, .14
5171	24-1.....	.564	.25	26,250	105,000	29,500	118,000	.61	20.3	Diam., .34 = .091	63.7	Fine silky, with deep radial serrations.	.30*, .22, .09
5172	24-2.....	.564	.25	26,250	105,000	28,920	115,680	.60	20.0	Diam., .35 = .096	61.5	.....do	.09, .26*, .23
5173	S-12-1..	.505	.20	20,800	104,000	27,150	135,750	.23[1]	23.0	Diam., .38 = .113	43.3	Fine silky, with fine radial serrations.	
5174	S-12-4..	.505	.20	21,400	107,000	27,170	135.850	.28[1]	28.0	Diam., .37 = .108	46.2	.....do	
5192	25 No. 1.	.564	.25	16,000	64,000	27,710	110,840	.52	17.3	Diam., .48 = .181	27.6	Fine granular, radiating from a silky center.	.13, .26*, .13

[1] Elongations measured in 1 inch.

STEEL FOR RECEIVERS OF RIFLES.

No. 4953.

Marks, R_{10}.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	0.	.....	Elastic limit.
7,750	31,000	.012333	.011333	.....	.....	
8,000	32,000	.015000	.002667	.....	.....	
8,250	33,000	.016167	.001167	.....	.....	
8,500	34,000	.018500	.002333	.....	.....	
8,750	35,000	.020333	.001833	.....	.....	
9,000	36,000	.023000	.002667	.....	.....	
9,250	37,000	.025000	.002000	.....	.....	
9,500	38,000	.027667	.002667	.....	.....	
9,750	39,000	.030000	.002333	.....	.....	
10,000	40,000	.033000	.003000	.....	.....	
10,250	41,000	.035667	.002667	.....	.....	
10,500	42,000	.039333	.003666	.....	.....	
10,750	43,000	.041667	.002334	.....	.....	
11,000	44,000	.046333	.004666	.....	.....	
11,250	45,000	.049333	.003000	.....	.....	
11,500	46,000	.054333	.005000	.....	.....	
11,750	47,000	.058333	.004000	.....	.....	
12,000	48,000	.064667	.006334	.....	.....	
12,250	49,000	.068667	.004000	.....	.....	
12,500	50,000	.0767	.008033	.....	.....	
13,000	52,000	.0967	.0200	.....	.....	
13,500	54,000	.1200	.0233	.....	.....	
14,000	56,000	.1600	.0400	.....	.....	
14,620	58,480	.2100	.0500	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	58,480
Elastic limit per square inch of original section	do...	30,000
Elongation per inch after rupture	inch..	.3367
Elongation per inch under strain at elastic limit	do...	.001000
Reduction in diameter at point of rupture	do...	.214
Reduction in area after rupture, per cent of original section		61.5
Position of rupture		1″.4 from neck
Character of broken surface		silky
Elongation of inch sections		″.22, ″.50*, ″.29

Chemical composition.

	Per cent.
Total carbon	0.144
Graphitic carbon	0.028
Combined carbon	0.116
Manganese	0.655
Silicon	0.019
Sulphur	0.126
Phosphorus	0.058
Copper	0.022

No. 4957.

Marks, 11 R.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.		
2,500	10,000	.000300	.000233			
5,000	20,000	.000633	.000333			
7,500	30,000	.000967	.000334	0.		
7,750	31,000	.001000	.000033			
8,000	32,000	.001033	.000033			
8,250	33,000	.001067	.000034			
8,500	34,000	.001133	.000066			
8,750	35,000	.001200	.000067			
9,000	36,000	.001267	.000067			
9,250	37,000	.001300	.000033			
9,500	38,000	.001333	.000033			
9,750	39,000	.001367	.000034			Elastic limit; load fell.
9,000	36,000	.022167	.020800			
9,250	37,000	.023600	.001433			
9,500	38,000	.024667	.001067			
9,750	39,000	.027333	.002666			
10,000	40,000	.030000	.002667			
10,250	41,000	.032000	.002000			
10,500	42,000	.034667	.002667			
10,750	43,000	.037667	.003000			
11,000	44,000	.041333	.003666			
11,250	45,000	.044333	.003000			
11,500	46,000	.0500	.005667			
12,000	48,000	.0600	.0100			
12,500	50,000	.0700	.0100			
13,000	52,000	.0867	.0167			
13,500	54,000	.1033	.0166			
14,000	56,000	.1333	.0300			
14,500	58,000	.2000	.0667			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	58,000
Elastic limit per square inch of original section	do...	39,000
Elongation per inch after rupture	inch..	.3167
Elongation per inch under strain at elastic limit	do...	.001367
Reduction in diameter at point of rupture	do...	.194
Reduction in area after rupture, per cent of original section		57.0
Position of rupture		at middle of stem
Character of broken surface		fine silky
Elongation of inch sections		″.22, ″.51*, ″.22

Chemical composition.

	Per cent.
Total carbon	0.174
Graphitic carbon	0.020
Combined carbon	0.154
Manganese	0.672
Silicon	0.047
Sulphur	0.095
Phosphorus	0.050
Copper	0.040

No. 4970.

Marks, 14 R.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001367	.000367	0.	.....	
11,000	44,000	.001500	.000133	.....	.....	Elastic limit.
		.014267	.012767	.....	.....	
11,250	45,000	.014600	.000333	.....	.....	
11,500	46,000	.015000	.000400	.....	.....	
11,750	47,000	.016000	.001000	.....	.....	
12,000	48,000	.017000	.001000	.....	.....	
12,250	49,000	.017833	.000833	.....	.....	
12,500	50,000	.019333	.001500	.....	.....	
13,000	52,000	.022000	.002667	.....	.....	
13,500	54,000	.025000	.003000	.....	.....	
14,000	56,000	.028000	.003000	.....	.....	
14,500	58,000	.031333	.003333	.....	.....	
15,000	60,000	.034667	.003334	.....	.....	
15,500	62,000	.038667	.004000	.....	.....	
16,000	64,000	.042667	.004000	.....	.....	
16,500	66,000	.048333	.005666	.....	.....	
17,000	68,000	.054667	.006334	.....	.....	
17,500	70,000	.061667	.007000	.....	.....	
18,000	72,000	.071000	.009333	.....	.....	
18,500	74,000	.0867	.0157	.....	.....	
19,000	76,000	.1033	.0166	.....	.....	
19,500	78,000	.1367	.0334	.....	.....	
19,720	78,880	.1800	.0433	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	78,880
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2400
Elongation per inch under strain at elastic limit	do...	.001500
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		1″.5 from neck
Character of broken surface		silky
Elongation of inch sections		″.16, ″.39*, ″.17

No. 4971.

Marks, 15 R.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001033	.000366	.....	.....	
10,000	40,000	.001367	.000334	0.	.....	
10,750	43,000	.001500	.000133	.....	.....	
12,500	50,000	.001733	.000233	0.	.....	
12,750	51,000	.001800	.000067	.....	.....	
13,000	52,000	.001867	.000067	.....	.....	
13,250	53,000	.001933	.000066	.....	.....	
13,500	54,000	.001967	.000034	.....	.....	
13,750	55,000	.002000	.000033	.....	.....	
14,000	56,000	.002033	.000033	.....	.....	Elastic limit.
		.010667	.008634	.....	.....	
14,250	57,000	.011333	.000666	.....	.....	
14,500	58,000	.011833	.000500	.....	.....	
14,750	59,000	.012667	.000834	.....	.....	
15,000	60,000	.013333	.000666	.....	.....	
15,500	62,000	.015000	.001667	.....	.....	
16,000	64,000	.017000	.002000	.....	.....	
16,500	66,000	.018667	.001667	.....	.....	
17,000	68,000	.020000	.001333	.....	.....	
17,500	70,000	.022167	.002167	.....	.....	
18,000	72,000	.024000	.001833	.....	.....	
18,500	74,000	.025833	.001833	.....	.....	
19,000	76,000	.028333	.002500	.....	.....	
19,500	78,000	.030667	.002334	.....	.....	
20,000	80,000	.033333	.002666	.....	.....	
20,500	82,000	.036000	.002667	.....	.....	
21,000	84,000	.039000	.003000	.....	.....	
21,500	86,000	.042667	.003667	.....	.....	
22,000	88,000	.047000	.004333	.....	.....	
22,500	90,000	.051667	.004667	.....	.....	
23,000	92,000	.057667	.006000	.....	.....	
23,500	94,000	.0667	.009033	.....	.....	
24,000	96,000	.0767	.0100	.....	.....	
24,500	98,000	.0967	.0200	.....	.....	
24,950	99,800	.1367	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	99,800
Elastic limit per square inch of original section	do...	56,000
Elongation per inch after rupture	inch..	.1800
Elongation per inch under strain at elastic limit	do...	.002033
Reduction in diameter at point of rupture	do...	.104
Reduction in area after rupture, per cent of original section		33.5
Position of rupture		1″.1 from neck
Character of broken surface		silky, trace of granulation
Elongation of inch sections		″.23*, ″.20, ″.11

No. 4975.

Marks, 16 R.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000167	.000167	0.	.....	
2,500	10,000	.000333	.000166	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
8,750	35,000	.001233	.000233	.000033	.000033	
9,000	36,000	.001300	.000067	.....	.....	Elastic limit.
9,250	37,000	.023000	.021700	.....	.....	
9,500	38,000	.024667	.001667	.....	.....	
9,750	39,000	.026767	.002100	.....	.....	
10,000	40,000	.028667	.001900	.....	.....	
10,250	41,000	.031000	.002333	.....	.....	
10,500	42,000	.033967	.002967	.....	.....	
10,750	43,000	.035833	.001866	.....	.....	
11,000	44,000	.038333	.002500	.....	.....	
11,250	45,000	.041700	.003367	.....	.....	
11,500	46,000	.044667	.002967	.....	.....	
11,750	47,000	.048933	.004266	.....	.....	
12,000	48,000	.052333	.003400	.....	.....	
12,250	49,000	.057000	.004667	.....	.....	
12,500	50,000	.062333	.005333	.....	.....	
12,750	51,000	.0667	.004367	.....	.....	
13,000	52,000	.0733	.0066	.....	.....	
13,250	53,000	.0800	.0067	.....	.....	
13,500	54,000	.0900	.0100	.....	.....	
13,750	55,000	.1000	.0100	.....	.....	
14,000	56,000	.1133	.0133	.....	.....	
14,250	57,000	.1333	.0200	.....	.....	
14,500	58,000	.1600	.0267	.....	.....	
14,750	59,000	.2233	.0633	.....	.....	
14,800	59,200	.2767	.0534	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	59,200
Elastic limit per square inch of original section	do...	36,000
Elongation per inch after rupture	inch..	.3200
Elongation per inch under strain at elastic limit	do...	.001300
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1".71 from neck
Character of broken surface		fine silky
Elongation of inch sections		".25, ".52*, ".19

No. 4986.

Marks, 17 R.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
8,750	35,000	.001100	.000133	0.	.....	
10,000	40,000	.001333	.000233	0.	.....	
10,250	41,009	.001367	.000034	.....	.....	
10,500	42,000	.001367	0.	.....	.....	Elastic limit.
10,750	43,000	.025000	.023633	.....	.....	
11,000	44,000	.026767	.001767	.....	.....	
11,250	45,000	.029333	.002566	.....	.....	
11,500	46,000	.031667	.002334	.....	.....	
11,750	47,000	.033833	.002166	.....	.....	
16,350	65,400	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	65,400
Elastic limit per square inch of original section	do...	42,000
Elongation per inch after rupture	inch..	.3000
Elongation per inch under strain at elastic limit	do...	.001367
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		1".26 from neck
Character of broken surface		fine silky
Elongation of inch sections		".44", ".26, ".20

No. 4994.

Marks, 18 R.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000667	.000367	.....	.....	
7,500	30,000	.001000	.000333	.....	.....	
10,000	40,000	.001367	.000367	0.	.....	
10,250	41,000	.001367	0.	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001500	.000067	.....	.....	
11,250	45,000	.001567	.000067	.....	.....	
11,500	46,000	.001633	.000066	.....	.....	
11,750	47,000	.001667	.000034	.....	.....	Elastic limit.
12,000	48,000	.019333	.017666	.....	.....	
12,250	49,000	.021267	.001934	.....	.....	
12,500	50,000	.022933	.001666	.....	.....	
12,750	51,000	.024500	.001567	.....	.....	
13,000	52,000	.026333	.001833	.....	.....	
13,250	53,000	.028000	.001667	.....	.....	
13,500	54,000	.030000	.002000	.....	.....	
13,750	55,000	.032600	.002600	.....	.....	
14,000	56,000	.034100	.001500	.....	.....	
14,250	57,000	.036333	.002233	.....	.....	
14,500	58,000	.038333	.002000	.....	.....	
14,750	59,000	.041333	.003000	.....	.....	
15,000	60,000	.044000	.002667	.....	.....	
18,650	74,600	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	74,600
Elastic limit per square inch of original section	do...	47,000
Elongation per inch after rupture	inch..	.2700
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1".80 from neck
Character of broken surface		fine silky
Elongation of inch sections		".18, ".45*, ".18

No. 4995.

Marks, 19 R.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10.000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001333	.000366	0.	.....	Elastic limit.
10,250	41,000	.012333	.011009	.....	.....	
10,500	42,000	.015667	.003334	.....	.....	
10,750	43,000	.018000	.002333	.....	.....	
11,000	44,000	.027667	.009667	.....	.....	
11,250	45,000	.031433	.003766	.....	.....	
11,500	46,000	.032133	.000700	.....	.....	
11,750	47,000	.034333	.002200	.....	.....	
12,000	48,000	.037367	.003034	.....	.....	
12,500	50,000	.043333	.005966	.....	.....	
13,000	52,000	.050667	.007334	.....	.....	
13,500	54,000	.0633	.012633	.....	.....	
14,000	56,000	.0700	.0067	.....	.....	
14,500	58,000	.0833	.0133	.....	.....	
15,000	60,000	.1033	.0200	.....	.....	
15,500	62,000	.1300	.0267	.....	.....	
15,900	63,600	.2000	.0700	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	63,600
Elastic limit per square inch of original section	do...	40,000
Elongation per inch after rupture	inch..	.2533
Elongation per inch under strain at elastic limit	do...	.001333
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		″.80 from neck
Character of broken surface		silky, serrated
Elongation of inch sections		″.13 ″.8 ″.45*

No. 5017.

Marks, 20 R.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	0.	.....	
8,750	35,000	.001100	.000133	.....	.....	
10,000	40,000	.001300	.000200	0.	.....	
10,250	41,000	.001333	.000033	.....	.....	
10,500	42,000	.001333	0.	.....	.....	
10,750	43,000	.001367	.000034	.....	.....	Elastic limit; load fell.
9,000	36,000	.005000	.003633	.....	.....	
9,250	37,000	.006000	.001000	.....	.....	
9,500	38,000	.010667	.004667	.....	.....	
9,750	39,000	.014333	.003666	.....	.....	
10,000	40,000	.020333	.006000	.....	.....	
10,250	41,000	.023333	.003000	.....	.....	
10,500	42,000	.025667	.002334	.....	.....	
11,000	44,000	.028667	.003000	.....	.....	
11,500	46,000	.033333	.004666	.....	.....	
12,000	48,000	.037667	.003334	.....	.....	
12,500	50,000	.043333	.005666	.....	.....	
13,000	52,000	.049333	.006000	.....	.....	
13,500	54,000	.056667	.007334	.....	.....	
14,000	56,000	.066667	.010000	.....	.....	
14,500	58,000	.076000	.009333	.....	.....	
15,000	60,000	.085667	.009667	.....	.....	
15,500	62,000	.124000	.038333	.....	.....	
15,940	63,760	.2033	.0793	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	63,760
Elastic limit per square inch of original section	do...	43,000
Elongation per inch after rupture	inch..	.3000
Elongation per inch under strain at elastic limit	do...	.001367
Reduction in diameter at point of rupture	do...	.154
Reduction in area after rupture, per cent of original section		47.2
Position of rupture		at middle of length
Character of broken surface		fine silky
Elongation of inch sections		".22, ".48*, ".20

No. 5018.

Marks, 21 R.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000067	.000067	0.	.....	
2,500	10,000	.000300	.000233	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	0.	.....	
8,750	35,000	.001133	.000166	.....	.....	
10,000	40,000	.001333	.000200	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001400	.000033	.....	.....	
10,750	43,000	.001433	.000033	.....	.....	
11,000	44,000	.001467	.000034	.....	.....	
11,250	45,000	.001533	.000066	.....	.....	Elastic limit; load fell.
10,750	43,000	.004267	.002734	.....	.....	
11,000	44,000	.007000	.002733	.....	.....	
11,250	45,000	.012333	.005333	.....	.....	
11,500	46,000	.018333	.006000	.....	.....	
11,750	47,000	.022000	.003667	.....	.....	
12,000	48,000	.024333	.002333	.....	.....	
12,500	50,000	.028333	.004000	.....	.....	
13,000	52,000	.033333	.005000	.....	.....	
13,500	54,000	.038333	.005000	.....	.....	
14,000	56,000	.044333	.006000	.....	.....	
14,500	58,000	.051333	.007000	.....	.....	
15,000	60,000	.060000	.008667	.....	.....	
15,500	62,000	.069333	.009333	.....	.....	
16,000	64,000	.0800	.010677	.....	.....	
16,500	66,000	.1033	.0233	.....	.....	
17,000	68,000	.1333	.0300	.....	.....	
17,260	69,040	.1767	.0434	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	69,040
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2333
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.134
Reduction in area after rupture, per cent of original section		41.9
Position of rupture		1". 08 from neck
Character of broken surface		fine silky; contained an irregular shaped hole ". 02 diameter, near the center of the specimen.
Elongation of inch sections		". 31*, ". 21, ". 18

No. 5162.

Marks, 22 R.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Sucessive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000167	.000167	0.	.....	
2,500	10,000	.000300	.000133	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.001000	.000367	.....	.....	
8,750	35,000	.001167	.000167	.....	.....	
10,000	40,000	.001333	.000166	0.	.....	
10,250	41,000	.001367	.000034	.....	.....	
10,500	42,000	.001433	.000066	.....	.....	
10,750	43,000	.001467	.000034	.....	.....	Elastic limit.
11,000	44,000	.006833	.005366	.....	.....	
11,250	45,000	.019533	.012700	.....	.....	
11,500	46,000	.019933	.000400	.....	.....	
11,750	47,000	.020667	.000734	.....	.....	
12,000	48,000	.022000	.001333	.....	.....	
12,250	49,000	.023200	.001200	.....	.....	
12,500	50,000	.024967	.001767	.....	.....	
13,000	52,000	.027967	.003000	.....	.....	
13,500	54,000	.031667	.003700	.....	.....	
14,000	56,000	.035533	.003866	.....	.....	
14,500	58,000	.039867	.004334	.....	.....	
15,000	60,000	.045000	.005133	.....	.....	
15,500	62,000	.0533	.0083	.....	.....	
16,000	64,000	.0567	.0034	.....	.....	
16,500	66,000	.0633	.0066	.....	.....	
17,000	68,000	.0767	.0134	.....	.....	
17,500	70,000	.0900	.0133	.....	.....	
18,000	72,000	.1100	.0200	.....	.....	
18,500	74,000	.1533	.0433	.....	.....	
18,560	74,240	.1733	.0200	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	74,240
Elastic limit per square inch of original section	do...	43,000
Elongation per inch after rupture	inch..	.2467
Elongation per inch under strain at elastic limit	do...	.001467
Reduction in diameter at point of rupture	do...	.144
Reduction in area after rupture, per cent of original section		44.6
Position of rupture		".75 from neck
Character of broken surface		fine silky
Elongation of inch sections		".42*, ".18, ".14

No. 5200.

Marks, 24 R.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000133	.000133	0.	.....	
2,500	10,000	.000333	.000200	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	0.	.....	
8,750	35,000	.001133	.000133	.....	.....	
10,000	40,000	.001333	.000200	.000033	.000033	
11,250	45,000	.001467	.000134	.....	.....	
11,500	46,000	.001533	.000066	.....	.....	Elastic limit.
		.015667	.014134	.....	.....	
11,750	47,000	.016600	.000933	.....	.....	
12,000	48,000	.018667	.002067	.....	.....	
12,500	50,000	.020333	.001666	.....	.....	
13,000	52,000	.023000	.002667	.....	.....	
13,500	54,000	.026000	.003000	.....	.....	
14,000	56,000	.030000	.004000	.....	.....	
14,500	58,000	.033667	.003667	.....	.....	
15,000	60,000	.038000	.004333	.....	.....	
15,500	62,000	.042667	.004667	.....	.....	
16,000	64,000	.048000	.005333	.....	.....	
16,500	66,000	.0567	.0087	.....	.....	
17,000	68,000	.0633	.0066	.....	.....	
17,500	70,000	.0700	.0067	.....	.....	
18,000	72,000	.0833	.0133	.....	.....	
18,500	74,000	.1033	.0200	.....	.....	
19,000	76,000	.1467	.0434	.....	.....	
19,080	76,360	.1800	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	76,360
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2800
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.164
Reduction in area after rupture, per cent of original section		49.7
Position of rupture		″.10 from neck
Character of broken surface		fine silky
Elongation of inch sections		″.43*, ″.24, ″.17

No. 5201.

Marks, 24 R.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
7,500	30,000	.001000	.000333	0.	.....	
8,750	35,000	.001167	.000167	.....	.....	
10,000	40,000	.001333	.000166	0.	.....	
11,250	45,000	.001500	.000167	.....	.....	
11,500	46,000	.001567	.000067	.....	.....	
11,750	47,000	.001633	.000066	.....	.....	
12,000	48,000	.001667	.000034	.....	.....	Elastic limit.
12,250	49,000	.016667	.015000	.....	.....	
12,500	50,000	.017333	.000666	.....	.....	
12,750	51,000	.018167	.000834	.....	.....	
13,000	52,000	.019400	.001233	.....	.....	
13,500	54,000	.022667	.003267	.....	.....	
14,000	56,000	.026000	.003333	.....	.....	
14,500	58,000	.029000	.003000	.....	.....	
15,000	60,000	.033000	.004000	.....	.....	
15,500	62,000	.037333	.004333	.....	.....	
16,000	64,000	.041667	.004334	.....	.....	
16,500	66,000	.047000	.005333	.....	.....	
17,000	68,000	.053667	.006667	.....	.....	
17,500	70,000	.0633	.009633	.....	.....	
18,000	72,000	.0700	.0067	.....	.....	
18,500	74,000	.0833	.0133	.....	.....	
19,000	76,000	.1000	.0167	.....	.....	
19,490	77,960	.1500	.0500	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	77,960
Elastic limit per square inch of original section	do...	48,000
Elongation per inch after rupture	inch..	.2300
Elongation per inch under strain at elastic limit	do...	.001667
Reduction in diameter at point of rupture	do...	.174
Reduction in area after rupture, per cent of original section		52.2
Position of rupture		1" from neck
Character of broken surface		fine silky
Elongation of inch sections		".38*, ".21, ".10

TABULATION OF TENSION SPECIMENS FROM STEEL FOR RECEIVERS OF RIFLES.

No. of test.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 3 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of inch sections.		
				Total.	Per square inch.	Total.	Per square inch.								
			Sq. in.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Inch.*	*Per ct.*	*Inch. Sq.in.*	*Per ct.*		"	"	"
4953	10 R ...	.564	.25	7,500	30,000	14,620	58,480	1.01	33.7	Diam., .35 = .096	61.5	Silky	.22,	.50*,	.29
4957	11 R ...	.564	.25	9,750	39,000	14,500	58,000	.95	31.7	Diam., .37 = .108	57.0	Fine silky	.22,	.51*,	.22
4970	14 R ...	.564	.25	11,000	44,000	19,720	78,880	.72	24.0	Diam., .42 = .139	44.6	Silky	.16,	.39*,	.17
4971	15 R ...	.564	.25	14,000	56,000	24,050	99,800	.54	18.0	Diam., .46 = .166	33.5	Silky; trace of granulation	.23*,	.20,	.11
4975	16 R ...	.564	.25	9,000	36,000	14,800	59,200	.96	32.0	Diam., .40 = .126	49.7	Fine silky	.25,	.52*,	.19
4986	17 R ...	.564	.25	10,500	42,000	16,350	65,400	.90	30.0	Diam., .40 = .126	49.7	.....do	.44,	.26,	.20
4994	18 R ...	.564	.25	11,750	47,000	18,650	74,600	.81	27.0	Diam., .39 = .119	52.2	.....do	.18,	.45*,	.18
4995	19 R ...	.564	.25	10,000	40,000	15,900	63,600	.76	25.3	Diam., .39 = .119	52.2	Silky, serrated	.13,	.18,	.45*
5017	20 R ...	.564	.25	10,750	43,000	15,940	63,760	.90	30.0	Diam., .41 = .132	47.2	Fine silky	.22,	.48*,	.20
5018	21 R ...	.564	.25	11,250	45,000	17,260	69,040	.70	23.3	Diam., .43 = .145	41.9	.....do	.31*,	.21,	.18
5162	22 R ...	.564	.25	10,750	43,000	18,560	74,240	.74	24.7	Diam., .42 = .139	44.6	.....do	.42*,	.18,	.14
5200	24 R ...	.564	.25	11,500	46,000	19,090	76,360	.84	28.0	Diam., .40 = .126	49.7	.....do	.43*,	.24,	.17
5201	24 R ...	.564	.25	12,000	48,000	19,490	77,960	.69	23.0	Diam., .39 = .119	52.2	.....do	.38*,	.21,	.10

STEEL CASTING FOR 15-INCH CARRIAGE TRUCK WHEEL PLATE.

No. 5187.

Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000333	.000233	.....	.....	
5,000	20,000	.000667	.000334	.....	.....	
6,250	25,000	.000867	.000200	.....	.....	
6,500	26,000	.000900	.000033	.....	.....	
6,750	27,000	.000967	.000067	.....	.....	Elastic limit.
7,000	28,000	.001100	.000333	.000233	.000233	
7,250	29,000	.001333	.000233	.....	.....	
7,500	30,000	.001600	.000267	.000467	.000234	
7,750	31,000	.001733	.000133	.....	.....	
8,000	32,000	.001900	.000167	.....	.....	
8,250	33,000	.002300	.000400	.....	.....	
8,500	34,000	.004000	.001700	.....	.....	
8,750	35,000	.007000	.003000	.005767	.005300	
9,000	36,000	.009667	.002667	.....	.....	
9,500	38,000	.011933	.002266	.....	.....	
10,000	40,000	.014667	.002734	.....	.....	
10,500	42,000	.017333	.002666	.....	.....	
11,000	44,000	.020333	.003000	.....	.....	
11,500	46,000	.023000	.002667	.....	.....	
12,000	48,000	.0800	.0570	.....	.....	
12,500	50,000	.0930	.0130	.....	.....	
13,000	52,000	.10	.0070	.....	.....	
13,500	54,000	.11	.01	.....	.....	
14,000	56,000	.13	.02	.....	.....	
14,500	58,000	.16	.03	.....	.....	
15,000	60,000	.18	.02	.....	.....	
15,500	62,000	.21	.03	.....	.....	
16,000	64,000	.25	.04	.....	.....	
16,500	66,000	.31	.06	.....	.....	
16,690	67,760	.39	.08	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	66,760
Elastic limit per square inch of original section	do...	27,000
Elongation per inch after rupture	inch..	.1300
Elongation per inch under strain at elastic limit	do...	.000967
Reduction in diameter at point of rupture	do...	.054
Reduction in area after rupture, per cent of original section		18.3
Position of rupture		".50 from neck
Character of broken surface		granular; opened cracks in stem in vicinity of fracture
Elongation of inch sections		".18*, ".11, ".10

Chemical composition.

	Per cent.
Total carbon	0.286
Graphitic carbon	0.046
Combined carbon	0.240
Manganese	0.665
Silicon	0.220
Sulphur	0.099
Phosphorus	0.072
Copper	0.000

STEEL FORGED BARS.

STEEL FORGED BARS.

No. 6207.

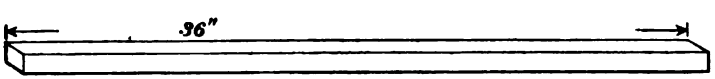
Bar forged down in arsenal smith shop from billet 12″ × 5½″.
Sectional area, 1″.05 × 1″.06 = 1.11 square inches.
Elastic limit, 72,200 pounds = 65,050 pounds per square inch.
Tensile strength, 111,200 pounds = 100,180 pounds per square inch.
Elongation in 10 inches, 1″.48 = 14.8 per cent.
Elongation of inch sections, ″.08, ″.11, ″.09, ″.10, ″.10, ″.11, ″.13, ″.14, ″.17, ″.45*.
Area at fracture, ″.83 × ″.83 = .689 square inch.
Contraction of area, 37.9 per cent.
Appearance of fracture, fine silky.

No. 6208.

Bar forged down in arsenal smith shop from cast ingot 7″ × 7″.
Sectional area, 1″.08 × 1″.08 = 1.17 square inches.
Elastic limit, 65,150 pounds = 55,680 pounds per square inch.
Tensile strength, 101,980 pounds = 87,160 pounds per square inch.
Elongation in 10 inches, 2″.18 = 21.8 per cent.
Elongation of inch sections, ″.22, ″.50, ″.21, ″.18, ″.17, ″.15, ″.20, ″.18, ″.17, ″.20.
Area at fracture, ″.84 × ″.85 = .714 square inch.
Contraction of area, 39 per cent.
Appearance of fracture, fine silky.

No. 6470.

Steel bar forged down in arsenal smith shop from billet:

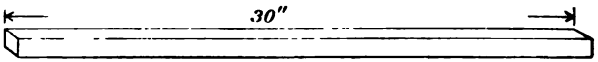


Sectional area, 1″.02 × 1″.02 = 1.04 square inches.
Elastic limit, 45,200 pounds = 43,460 pounds per square inch.
Tensile strength, 69,400 pounds = 66,730 pounds per square inch.
Elongation in 10 inches, 1″.70 = 17.0 per cent.
Elongation of inch sections, ″.14, ″.14, ″.14, ″.17, ″.19, ″.16, ″.18, ″.19, ″.19, ″.20.
Area at fracture, ″.71 × ″.73 = .518 square inch.
Contraction of area, 50.2 per cent.
Appearance of fracture, fine silky.

Steel Used in Piston Rod.

No. 6471.

Forged down in arsenal smith shop from billet:



Sectional area, 1″.06 × 1″.04 = 1.10 square inches.
Elastic limit, 73,600 pounds = 66,910 pounds per square inches.
Tensile strength, 118,700 pounds = 107,910 pounds per square inch.
Elongation in 10 inches, 1″.33 = 13.3 per cent.
Elongation of inch sections, ″.08, ″.08, ″.06, ″.08, ″.08, ″.12, ″.12, ″.12, ″.42*, ″.17.
Area at fracture, ″.83 × ″.83 = .689 per square inch.
Contraction of area, 37.4 per cent.
Appearance of fracture, fine silky.

TOOL STEEL.

TOOL STEEL.

Samples Nos. 5154 and 5155 tested in condition received without lathe finishing.

No. 5154.

Annealed sample of steel used principally for reamers, taps, and such tools. Branded "W. Jessop & Sons. Cast steel warranted, annealed."
Total length, 5′ 2½″.
Diameter, 1″.262.
Sectional area, 1.251 square inches.
Length of sample between jaws of machine, 34″.
Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,251	1,000	0.	0.	0.	0.	Initial load.
6,255	5,000	.000100	.000100	0.	.....	
12,510	10,000	.000230	.000130	.....	.....	
18,765	15,000	.000390	.000160	.....	.....	
25,020	20,000	.000520	.000130	0.	.....	
31,275	25,000	.000690	.000170	.....	.....	
37,530	30,000	.000840	.000150	0.	.....	
43,785	35,000	.000980	.000140	.....	.....	
50,040	40,000	.001120	.000140	—.000100	—.000100	
51,291	41,000	.001140	.000020	.....	.....	
52,542	42,000	.001180	.000040	.....	.....	
53,793	43,000	.001200	.000020	.....	.....	
55,044	44,000	.001250	.000050	.....	.....	Elastic limit.
56,295	45,000	.005000	.003750	.....	.....	
57,546	46,000	.008500	.003500	.....	.....	
58,797	47,000	.011300	.002800	.....	.....	
60,048	48,000	.011610	.000310	.....	.....	
61,299	49,000	.012300	.000690	.....	.....	
62,550	50,000	.013180	.000880	.011030	.011130	
65,052	52,000	.0150	.001820	.....	.....	
67,554	54,000	.0170	.0020	.....	.....	
70,056	56,000	.0190	.0020	.....	.....	
72,558	58,000	.0210	.0020	.....	.....	
75,060	60,000	.0230	.0020	.....	.....	
77,562	62,000	.0260	.0030	.....	.....	
80,064	64,000	.0290	.0030	.....	.....	
82,566	66,000	.0320	.0030	.....	.....	
85,068	68,000	.0360	.0040	.....	.....	
87,570	70,000	.0400	.0040	.....	.....	
90,072	72,000	.0460	.0060	.....	.....	
92,574	74,000	.0510	.0050	.....	.....	
95,076	76,000	.0600	.0090	.....	.....	
97,578	78,000	.0710	.0110	.....	.....	
100,080	80,000	.0850	.0140	.....	.....	
102,582	82,000	.1140	.0290	.....	.....	
103,300	82,570	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	82,570
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture in 30 inches	inch..	.1370
Elongation per inch under strain at elastic limit	do...	.001250
Reduction in diameter at point of rupture	do...	.272
Reduction in area after rupture, per cent of original section		38.4
Character of broken surface	fine granular serrated, radiating from a silky eccentric spot	
Elongation of 5-inch sections	1″.28*, ″.87, ″.67, ″.50, ″.41, ″.88	

No. 5155.

Unannealed sample of steel, used principally for twist drills. Jessop's steel. Not branded.

Total length, 6′ 1″.

Diameter { Maximum, 1″.271. Minimum, 1″.264. Mean, 1″.268.

Sectional area, 1.263 square inches.

Gauged length, 10″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,263	1,000	0.	0.	0.	0.	Initial load.
6,315	5,000	.000120	.000120	0.	.....	
12,630	10,000	.000300	.000180	.....	.....	
18,945	15,000	.000480	.000180	.....	.....	
25,260	20,000	.000620	.000140	.....	.....	
31,575	25,000	.000790	.000170	.....	.....	
37,890	30,000	.000980	.000190	0.	.....	
44,205	35,000	.001120	.000140	.....	.....	
50,520	40,000	.001300	.000180	0.	.....	
56,835	45,000	.001480	.000180	.....	.....	
63,150	50,000	.001630	.000150	0.	.....	
69,465	55,000	.001800	.000170	.....	.....	
75,780	60,000	.002000	.000200	.....	.....	
82,095	65,000	.002180	.000180	.....	.....	
88,410	70,000	.002320	.000140	0.	.....	
94,725	75,000	.002500	.000180	.....	.....	
95,988	76,000	.002520	.000020	.....	.....	
97,251	77,000	.002560	.000040	.....	.....	
98,514	78,000	.002590	.000030	.....	.....	
99,777	79,000	.002620	.000030	.....	.....	
101,040	80,000	.002680	.000060	0.	.....	Elastic limit.
102,303	81,000	.010760	.008080	.....	.....	
103,566	82,000	.010910	.000150	.....	.....	
1,263	1,000	.007200	—.003710	.....	.....	
6,315	5,000	.007310	+.000110	.....	.....	
12,630	10,000	.007500	.000190	.....	.....	
25,260	20,000	.007890	.000390	.....	.....	
37,890	30,000	.008270	.000380	.....	.....	
50,520	40,000	.008650	.000380	.....	.....	
63,150	50,000	.009090	.000440	.....	.....	
75,780	60,000	.009550	.000460	.....	.....	
88,410	70,000	.010090	.000540	.....	.....	
75,780	60,000	.009750	—.000340	.....	.....	
63,150	50,000	.009390	—.000360	.....	.....	
50,520	40,000	.009000	—.000390	.....	.....	
37,890	30,000	.008600	—.000400	.....	.....	
25,260	20,000	.008190	—.000410	.....	.....	
12,630	10,000	.007710	—.000480	.....	.....	
1,263	1,000	.007260	—.000450	.....	.....	
106,092	84,000	.0120	.004740	.....	.....	
108,618	86,000	.0130	.0010	.....	.....	
111,144	88,000	.0140	.0010	.....	.....	
113,670	90,000	.0150	.0010	.....	.....	
116,196	92,000	.0160	.0010	.....	.....	
118,722	94,000	.0170	.0010	.....	.....	
121,248	96,000	.0190	.0020	.....	.....	
123,774	98,000	.0200	.0010	.....	.....	
126,300	100,000	.0210	.0010	.....	.....	Rested 16 hours.
128,826	102,000	.0210	.0000+	.....	.....	
131,352	104,000	.0220	.0010	.....	.....	
133,878	106,000	.0240	.0020	.....	.....	
136,404	108,000	.0260	.0020	.....	.....	
138,930	110,000	.0270	.0010	.....	.....	
141,456	112,000	.0290	.0020	.....	.....	
143,982	114,000	.0300	.0010	.....	.....	
146,508	116,000	.0320	.0020	.....	.....	
149,034	118,000	.0350	.0030	.....	.....	
151,560	120,000	.0370	.0020	.....	.....	
154,086	122,000	.0400	.0030	.....	.....	
156,612	124,000	.0450	.0050	.....	.....	
159,138	126,000	.0490	.0040	.....	.....	
161,664	128,000	.0570	.0080	.....	.....	
164,190	130,000	.0660	.0090	.....	.....	
166,716	132,000	.0810	.0150	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	132,000
Elastic limit per square inch of original section	do...	80,000
Elongation per inch after rupture in 30 inches	inch..	.074
Elongation per inch under strain at elastic limit	do...	.002680
Reduction in diameter at point of rupture	do...	.048
Reduction in area after rupture, per cent of original section		7.4
Character of broken surface	fine silky serrated radiating from a silky spot at the center	

TOOL STEEL FROM SPRINGFIELD ARMORY.

No. 4972.

Marks, S. T.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.		
2,500	10,000	.000333	.000233			
5,000	20,000	.000667	.000334			
7,500	30,000	.001000	.000333			
10,000	40,000	.001333	.000333	0.		
11,250	45,000	.001533	.000200			
12,500	50,000	.001700	.000167			
13,750	55,000	.001900	.000200			
15,000	60,000	.002033	.000133	0.		
15,250	61,000	.002067	.000034			
15,500	62,000	.002133	.000066			Elastic limit.
15,750	63,000	.002267	.000134			
16,000	64,000	.004000	.001733			
16,250	65,000	.005000	.001000			
16,500	66,000	.005767	.000767			
16,750	67,000	.006067	.000300			
17,000	68,000	.006433	.000366			
17,500	70,000	.007233	.000800			
18,000	72,000	.008033	.000800			
18,500	74,000	.008667	.000634			
19,000	76,000	.009333	.000666			
19,500	78,000	.010167	.000834			
20,000	80,000	.011000	.000833			
20,500	82,000	.011733	.000733			
21,000	84,000	.012600	.000867			
21,500	86,000	.013500	.000900			
22,000	88,000	.014333	.000833			
22,500	90,000	.015200	.000867			
23,500	94,000	.017000	.001800			
24,500	98,000	.019000	.002000			
25,000	100,000	.020267	.001267			
26,000	104,000	.022167	.001900			
27,000	108,000	.024833	.002666			
28,000	112,000	.027667	.002834			
29,000	116,000	.0333	.005633			
30,000	120,000	.0367	.0034			
31,000	124,000	.0433	.0066			
32,000	128,000	.0500	.0067			
33,000	132,000	.0633	.0133			
33,200	132,800	.0733	.0100			Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	132,800
Elastic limit per square inch of original section	do...	62,000
Elongation per inch after rupture	inch..	.0633
Elongation per inch under strain at elastic limit	do...	.002183
Reduction in diameter at point of rupture	do...	.024
Reduction in area after rupture, per cent of original section		8.4
Position of rupture		at neck
Character of broken surface	granular, radiating from center punch mark defining end of gauged length.	
Elongation of inch sections		".11, ".04, ".04
Diameter ½ inch from fracture		".53

TOOL STEEL, ANNEALED, FROM SPRINGFIELD ARMORY.

No. 4973.

Marks, S. T. A.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30,000	.000967	.000334	.....	.....	
10,000	40,000	.001300	.000333	0.	.....	
10,750	43,000	.001367	.000067	.....	.....	
11,000	44,000	.001400	.000033	.....	.....	Elastic limit.
11,250	45,000	.008333	.006933	.....	.....	
11,500	46,000	.011333	.003000	.....	.....	
11,750	47,000	.011700	.000367	.....	.....	
12,000	48,000	.012000	.000300	.....	.....	
12,250	49,000	.012500	.000500	.....	.....	
12,500	50,000	.013333	.000833	.....	.....	
12,750	51,000	.013733	.000400	.....	.....	
13,000	52,000	.014500	.000767	.....	.....	
13,500	54,000	.016167	.001667	.....	.....	
14,000	56,000	.018000	.001833	.....	.....	
14,500	58,000	.019500	.001500	.....	.....	
15,000	60,000	.021333	.001833	.....	.....	
15,500	62,000	.023433	.002100	.....	.....	
16,000	64,000	.026000	.002567	.....	.....	
16,500	66,000	.028667	.002667	.....	.....	
17,000	68,000	.031333	.002666	.....	.....	
17,500	70,000	.035000	.003667	.....	.....	
18,000	72,000	.039000	.004000	.....	.....	
18,500	74,000	.044000	.005000	.....	.....	
19,000	76,000	.049333	.005333	.....	.....	
19,500	78,000	.056667	.007334	.....	.....	
20,000	80,000	.064000	.007333	.....	.....	
20,500	82,000	.0867	.0227	.....	.....	
21,000	84,000	.1067	.0200	.....	.....	
21,300	85,200	.1400	.0333	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,200
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.1433
Elongation per inch under strain at elastic limit	do...	.001400
Reduction in diameter at point of rupture	do...	.124
Reduction in area after rupture, per cent of original section		39.2
Position of rupture		″.95 from neck
Character of broken surface		granular, radiating from a fine silky center
Elongation of inch sections		″.07, ″.11, ″.25*

TOOL STEEL, ANNEALED, FROM SPRINGFIELD ARMORY.

No. 5016.

Marks, S. T. A_2.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000100	.000100	0.	.....	
2,500	10,000	.000300	.000200	.....	.....	
5,000	20,000	.000633	.000333	.....	.....	
7,500	30.000	.000967	.000334	.....	.....	
10,000	40,000	.001333	.000366	0.	.....	
11,250	45.000	.001533	.000200	.....	.....	Elastic limit.
11,500	46,000	.001667	.000134	.....	.....	
11,750	47,000	.002067	.000400	.....	.....	
12,000	48,000	.004867	.002800	.....	.....	
12,250	49,000	.006300	.001433	.....	.....	
12,500	50,000	.007667	.001367	.....	.....	
12,750	51,000	.009833	.002166	.....	.....	
13,000	52,000	.010500	.000667	.....	.....	
13,250	53,000	.011167	.000667	.....	.....	
13,500	54,000	.011667	.000500	.....	.....	
14,000	56,000	.012833	.001166	.....	.....	
14,500	58,000	.014000	.001167	.....	.....	
15,000	60,000	.014833	.000833	.....	.....	
25,500	62,000	.016000	.001167	.....	.....	
16,000	64,000	.017000	.001000	.....	.....	
16,500	66,000	.018333	.001333	.....	.....	
17,000	68,000	.019400	.001067	.....	.....	
17,500	70,000	.020833	.001433	.....	.....	
18,000	72,000	.022400	.001567	.....	.....	
18,500	74,000	.024000	.001600	.....	.....	
19,000	76,000	.025933	.001933	.....	.....	
19,500	78,000	.027833	.001900	.....	.....	
20,000	80,000	.030000	.002167	.....	.....	
20,500	82,000	.032667	.002667	.....	.....	
21,000	84,000	.035333	.002666	.....	.....	
21,500	86,000	.038500	.003167	.....	.....	
22,000	88,000	.042000	.003500	.....	.....	
22,500	90,000	.047000	.005000	.....	.....	
23,000	92,000	.053333	.006333	.....	.....	
23,500	94,000	.061667	.008334	.....	.....	
23,980	95,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	95,920
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.0667
Elongation per inch under strain at elastic limit	do...	.001533
Reduction in diameter at point of rupture	do...	.024
Reduction in area after rupture, per cent of original section		8.4
Position of rupture		1″.45 from neck
Character of broken surface		fine granular
Elongation of inch sections		″.06, ″.07*, ″.07

STEEL SPECIMENS

FROM THE

BENJ. ATHA AND ILLINGWORTH CO., NEWARK, N. J.

TESTS FOR COMPARISON OF TESTING MACHINES.

Specimens Nos. 5205 and 5206 had previously been strained with the same loads here applied, and duplicate bars of those ruptured were also tested at Newark.

No. 5205.

Marks, $\frac{C\ T}{S\ L}$,
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

This specimen was put on centers and found to be crooked in the stem; hence micrometer observations of elongations were taken on two sides.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000250	.000250			
2,000	10,000	.000400	.000150			
3,000	15,000	.000700	.000300			
4,000	20,000	.000850	.000150			
5,000	25,000	.001100	.000250			
6,000	30,000	.001300	.000200			
5,000	25,000	.001100	.000200			
4,000	20,000	.000900	.000200			
3,000	15,000	.000700	.000200			
2,000	10,000	.000500	.000200			
1,000	5,000	.000300	.000200			
200	1,000			.000050	.000050	Specimen rotated 180° and observations repeated.
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150			
2,000	10,000	.000350	.000200			
3,000	15,000	.000500	.000150			
4,000	20,000	.000700	.000200			
5,000	25,000	.000900	.000200			
6,000	30,000	.001100	.000200			
5,000	25,000	.000900	.000200			
4,000	20,000	.000700	.000200			
3,000	15,000	.000500	.000200			
2,000	10,000	.000350	.000150			
1,000	5,000	.000150	.000200			
200	1,000			0.		

No. 5206.

Marks, $\frac{C}{H}\ \frac{T}{L}$,
Diameter, $''.505$.
Sectional area, .20 square inch.
Gauged length, $2''$.
This specimen was put on centers and found to be crooked in the stem; hence micrometer observations of elongations were taken on two sides.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	.....	.....	
2,000	10,000	.000300	.000150	.....	.....	
3,000	15,000	.000500	.000200	.....	.....	
4,000	20,000	.000650	.000150	.....	.....	
5,000	25,000	.000800	.000150	.....	.....	
6,000	30,000	.000950	.000150	.....	.....	
7,000	35,000	.001150	.000200	.....	.....	
8,000	40,000	.001350	.000200	.....	.....	
7,000	35,000	.001150	.000200	.....	.....	
6,000	30,000	.000950	.000200	.....	.....	
5,000	25,000	.000800	.000150	.....	.....	
4,000	20,000	.000650	.000150	.....	.....	
3,000	15,000	.000450	.000200	.....	.....	
2,000	10,000	.000250	.000200	.....	.....	
1,000	5,000	.000100	.000150	.....	.....	
200	1,000	.....	.....	—.000050	—.000050	Rotated 180° and observation repeated.
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	.....	.....	
2,000	10,000	.000300	.000150	.....	.....	
3,000	15,000	.000450	.000150	.....	.....	
4,000	20,000	.000600	.000150	.....	.....	
5,000	25,000	.000800	.000200	.....	.....	
6,000	30,000	.001000	.000200	.....	.....	
7,000	35,000	.001200	.000200	.....	.....	
8,000	40,000	.001350	.000150	.....	.....	
7,000	35,000	.001200	.000150	.....	.....	
6,000	30,000	.001000	.000200	.....	.....	
5,000	25,000	.000800	.000200	.....	.....	
4,000	20,000	.000600	.000200	.....	.....	
3,000	15,000	.000450	.000150	.....	.....	
2,000	10,000	.000300	.000150	.....	.....	
1,000	5,000	.000100	.000200	.....	.....	
200	1,000	.....	.....	0.	.....	

No. 5207.

Marks, $\frac{C\ T}{S\ L}$
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000200	.000200	.....	.....	
2,000	10,000	.000500	.000300	.....	.....	
3,000	15,000	.000800	.000300	.....	.....	
4,000	20,000	.001000	.000200	.000050	.000050	
5,000	25,000	.001150	.000150	.....	.....	
6,000	30,000	.001300	.000150	.000050	0.	
7,000	35,000	.001400	.000100	.000100	.000050	
7,200	36,000	.001400	0.	.....	.....	
7,400	37,000	.001450	.000050	.....	.....	
7,600	38,000	.001450	0.	.....	.....	Elastic limit.
7,800	39,000	.017500	.016050	.....	.....	
8,000	40,000	.0200	.002500	.....	.....	
9,000	45,000	.0350	.0150	.....	.....	
12,680	63,400	.2100	.1750	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	63,400
Elastic limit per square inch of original section	do...	38,000
Elongation per inch after rupture	inch..	.3600
Elongation per inch under strain at elastic limit	do...	.001450
Reduction in diameter at point of rupture	do...	.185
Reduction in area after rupture, per cent of original section		59.8
Position of rupture		1".04 from neck
Character of broken surface		silky
Elongation of inch sections		".25, ".52

No. 5208.

Marks, $\frac{C\ T}{S\ L}$.
Diameter, ".505.
Sectional area, .20 square inch.
Gauged length, 2".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	.....	.....	
2,000	10,000	.000250	.000150	.....	.....	
3,000	15,000	.000450	.000200	.....	.....	
4,000	20,000	.000650	.000200	.....	.....	
5,000	25,000	.000800	.000150	.....	.....	
6,000	30,000	.000950	.000150	.....	.....	
7,000	35,000	.001200	.000250	.....	.....	
8,000	40,000	.001350	.000150	.....	.....	Elastic limit.
8,200	41,000	.0200	.018650	.....	.....	
9,000	45,000	.0350	.0150	.....	.....	
12,534	62,670	.2400	.2050	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	62,670
Elastic limit per square inch of original section	do...	40,000
Elongation per inch after rupture	inch..	.3550
Elongation per inch under strain at elastic limit	do...	.001350
Reduction in diameter at point of rupture	do...	.185
Reduction in area after rupture, per cent of original section		59.8
Position of rupture		".80 from neck
Character of broken surface		silky
Elongation of inch sections		".49*, ".22

No. 5209.

Marks, $\frac{C\ T}{S\ L_6}$
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	.....	.....	
2,000	10,000	.000300	.000200	.....	.....	
3,000	15,000	.000450	.000150	.....	.....	
4,000	20,000	.000600	.000150	.....	.....	
5,000	25,000	.000750	.000150	.....	.....	
6,000	30,000	.000900	.000150	0.	.....	
7,000	35,000	.001150	.000250	0.	.....	
7,600	38,000	.001300	.000150	.....	.....	Elastic limit.
7,800	39,000	.0150	.0137	.....	.....	
8,000	40,000	.0200	.0050	.....	.....	
9,000	45,000	.0350	.0150	.....	.....	
12,820	64,100	.2050	.1700	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	64,100
Elastic limit per square inch of original section	do...	38,000
Elongation per inch after rupture	inch..	.3700
Elongation per inch under strain at elastic limit	do ..	.001300
Reduction in diameter at point of rupture	do...	.185
Reduction in area after rupture, per cent of original section		59.8
Position of rupture		1″.2 from neck
Character of broken surface		silky
Elongation of inch sections		″.29, ″.45 *

No. 5210.

Marks, $\frac{CT}{HL}$.
Diameter, ″.505.
Sectional area, .20 square inch.
Gauged length, 2″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	
1,000	5,000	.000150	.000150	.....	.....	
2,000	10,000	.000300	.000150	.....	.....	
3,000	15,000	.000450	.000150	.....	.....	
4,000	20,000	.000600	.000150	.....	.....	
5,000	25,000	.000750	.000150	.....	.....	
6,000	30,000	.000900	.000150	—.000050	—.000050	
7,000	35,000	.001150	.000150	.....	.....	
8,000	40,000	.001300	.000150	—.000050	0.	
8,800	44,000	.001400	.000100	.....	.....	Elastic limit.
9,000	45,000	.001550	.000150	.....	.....	
		.009000	.007450	.....	.....	
10,000	50,000	.0100	.001000	.....	.....	
11,000	55,000	.0150	.0050	.....	.....	
12,000	60,000	.0250	.0100	.....	.....	
13,000	65,000	.0300	.0050	.....	.....	
14,000	70,000	.0400	.0100	.....	.....	
15,000	75,000	.0500	.0100	.....	.....	
16,000	80,000	.0750	.0250	.....	.....	
16,940	84,700	.1050	.0900	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,700
Elastic limit per square inch of original section	do...	44,000
Elongation per inch after rupture	inch..	.2650
Elongation per inch under strain at elastic limit	do...	.001400
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		1″.12 from neck
Character of broken surface		silky
Elongation of inch sections		″.21, ″.32*

No. 5211.

Marks, $\frac{C\ T}{R\ L_4}$
Diameter, $''.505$.
Sectional area, .20 square inch.
Gauged length, $2''$.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000150	.000150	.....	.....	
2,000	10,000	.000400	.000250	.....	.....	
3,000	15,000	.000550	.000150	.....	.....	
4,000	20,000	.000700	.000150	.....	.....	
5,000	25,000	.000800	.000100	.....	.....	
6,000	30,000	.000950	.000150	—.000050	—.000050	
7,000	35,000	.001100	.000150	.....	.....	
8,000	40,000	.001350	.000250	—.000050	0.	
9,000	45,000	.001500	.000150	—.000050	0.	
9,200	46,000	.001550	.000050	.....	.....	Elastic limit.
9,400	47,000	.011200	.009650	.....	.....	
9,600	48,000	.012050	.000850	.....	.....	
9,800	49,000	.012750	.000700	.....	.....	
10,000	50,000	.013550	.000800	.....	.....	
11,000	55,000	.0200	.006450	.....	.....	
12,000	60,000	.0250	.0050	.....	.....	
13,000	65,000	.0300	.0050	.....	.....	
14,000	70,000	.0400	.0100	.....	.....	
15,000	75,000	.0500	.0100	.....	.....	
16,000	80,000	.0700	.0200	.....	.....	
16,920	84,000	.1600	.0900	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	84,600
Elastic limit per square inch of original section	do...	46,000
Elongation per inch after rupture	inch..	.2650
Elongation per inch under strain at elastic limit	do...	.001550
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.8
Position of rupture		$1''$. 15 from neck
Character of broken surface		silky
Elongation of inch sections		$''.31^*, ''.22$

No. 5212.

Marks, $\frac{C\ T}{H\ L_5}$
Diameter, $''.505$.
Sectional area, .20 square inch.
Gauged length, $2''$.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
200	1,000	0.	0.	0.	0.	Initial load.
1,000	5,000	.000100	.000100	.....	.....	
2,000	10,000	.000300	.000200	.....	.....	
3,000	15,000	.000500	.000200	.....	.....	
4,000	20,000	.000700	.000200	.....	.....	
5,000	25,000	.000900	.000200	.....	.....	
6,000	30,000	.001100	.000200	.000050	.000050	
7,000	35,000	.001250	.000150	.....	.....	
8,000	40,000	.001450	.000200	.000050	0.	
9,000	45,000	.001650	.000200	.000050	0.	Elastic limit.
9,200	46,000	.010250	.008600	.....	.....	
9,400	47,000	.010600	.000350	.....	.....	
9,600	48,000	.011400	.000800	.....	.....	
9,800	49,000	.012250	.000850	.....	.....	
10,000	50,000	.013300	.001050	.....	.....	
11,000	55,000	.0150	.0017	.....	.....	
12,000	60,000	.0200	.0050	.....	.....	
13,000	65,000	.0300	.0100	.....	.....	
14,000	70,000	.0350	.0050	.....	.....	
15,000	75,000	.0500	.0150	.....	.....	
16,000	80,000	.0600	.0100	.....	.....	
17,000	85,000	.1200	.0600	.....	.....	
17,110	85,550	.1600	.0400	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	85,550
Elastic limit per square inch of original section	do...	45,000
Elongation per inch after rupture	inch..	.2750
Elongation per inch under strain at elastic limit	do...	.001650
Reduction in diameter at point of rupture	do...	.125
Reduction in area after rupture, per cent of original section		43.3
Position of rupture		$''.08$ from neck
Character of broken surface		silky
Elongation of inch sections		$''.32^*, ''.23$

CAST IRON

FROM

WATERTOWN ARSENAL FOUNDRY,

AND

PIG IRONS.

CAST IRON FROM WATERTOWN ARSENAL FOUNDRY, AND PIG IRONS.

The specimens of cast iron were taken from cylinders 18 inches long by 8 inches diameter, cored 3½ inches diameter, poured from the same metal as the castings they represented.

Specimens of pig iron were turned down directly from sample pigs.

The furnace charges were as follows:

The heads referred to in the furnace charges were heads of shell from previous casts.

The scrap iron used was old shot and shell, bolsters, and gun-carriage scrap of good quality.

Date of cast.	Furnace charge.	Pounds.	Furnace.	No. of tension test.
January 1, 1894	Muirkirk pig	3,000	Cupola	5078
	Old 8-inch shell	2,500		
	Heads	2,500		
	Scrap	500		
	Total	8,500		
August 1, 1893	Muirkirk pig	3,000	do	5080
	Shell	2,500		
	Heads	2,500		
	Scrap	500		
	Total	8,500		
April 24, 1894	Richmond pig No. 1	1,000	do	5114
	Richmond pig No. 2	1,000		
	Salisbury pig No. 4	1,500		
	Salisbury pig No. 4, high	1,500		
	Scrap	5,000		
	Total	10,000		
April 16, 1894	Salisbury pig No. 4	2,750	do	5113
	Salisbury pig No. 4, high	2,750		
	Scrap	4,500		
	Total	10,000		
October 16, 1893	Salisbury pig No. 4, high	4,000	do	5090
	Salisbury pig No. 4	4,000		
	Total	8,000		
October 23, 1893	Salisbury pig No. 4	1,250	do	5091
	Salisbury pig No. 4, high	1,250		
	Heads	2,000		
	Scrap	1,000		
	Shell	1,000		
	Total	6,500		
October 28, 1893	Salisbury pig No. 4	3,000	do	5092
	Salisbury pig No. 4, high	3,000		
	Shell	1,000		
	Heads	1,000		
	Scrap	1,000		
	Total	9,000		

Cast iron from Watertown Arsenal Foundry, and pig irons—Continued.

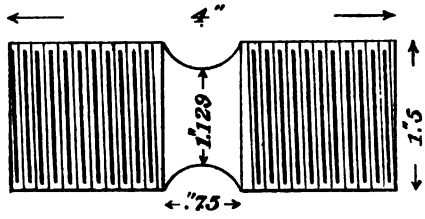
Date of cast.	Furnace charge.	Pounds.	Furnace.	No. of tension test.
March 14, 1894	Salisbury pig No. 4	6,000	Air furnace	5099
	Salisbury pig No. 4, high	2,000		
	Soft pig	4,000		
	Remelted pig	6,000		
	Total	18,000		
Do	Salisbury pig No. 4	2,250	Cupola	5100
	Salisbury pig No. 4, high	2,250		
	Scrap	4,500		
	Total	9,000		
May 15, 1894	Richmond pig No. 1	1,000	do	5115
	Richmond pig No. 2	1,000		
	Salisbury pig No. 4	1,500		
	Salisbury pig No. 4, high	1,500		
	Scrap	4,000		
	Total	9,000		
May 11, 1894	Salisbury pig No. 4	6,000	Air furnace	5116
	Salisbury pig No. 4, high	2,000		
	Soft pig	4,000		
	Remelted pig	6,000		
	Total	18,000		
Do	Salisbury pig No. 4	2,000	Cupola	5117
	Salisbury pig No. 4, high	2,000		
	Soft pig	2,000		
	Scrap	4,000		
	Total	10,000		
June 6, 1894	Richmond pig No. 1	450	do	5119
	Richmond pig No. 2	450		
	Salisbury pig No. 4	450		
	Salisbury pig No. 4, high	450		
	Scrap	3,000		
	Total	4,800		
June 21, 1893	Muirkirk pig	10,000	Air furnace	5079
	Soft pig	6,000		
	Remelted pig	10,000		
	Total	26,000		
June 15, 1894	Salisbury pig No. 4	2,500	do	5120
	Salisbury pig No. 4, high	2,500		
	Richmond pig No. 1	2,500		
	Richmond pig No. 2	2,500		
	Soft pig	6,000		
	Remelted pig	10,000		
	Total	26,000		
May 25, 1894	Salisbury pig No. 4	2,500	do	5118
	Salisbury pig No. 4, high	2,500		
	Richmond pig No 1	2,500		
	Richmond pig No 2	2,500		
	Soft pig	6,000		
	Remelted pig	14,000		
	Total	30,000		
November 21, 1893	Salisbury pig No. 4	6,000	do	5093
	Salisbury pig No. 4, high	2,000		
	Soft pig	4,000		
	Remelted pig	6,000		
	Total	18,000		
December 28, 1893	Salisbury pig No. 4	6,000	do	5094
	Salisbury pig No. 4, high	2,000		
	Soft pig	4,000		
	Remelted pig	6,000		
	Total	18,000		

Cast iron from Watertown Arsenal Foundry, and pig irons—Continued.

Date of cast.	Furnace charge.		Furnace.	No. of tension test.
		Pounds.		
February 2, 1894	Salisbury pig No. 4	6,000	Air furnace	5096
	Salisbury pig No. 4, high	2,000		
	Soft pig	4,000		
	Remelted pig	6,000		
	Total	18,000		
Do	Salisbury pig No. 4	2,250	Cupola	5095
	Salisbury pig No. 4, high	2,250		
	Scrap	5,500		
	Total	10,000		
April 18, 1894	Salisbury pig No. 4	2,500	Air furnace	5112
	Salisbury pig No. 4, high	2,500		
	Richmond pig No. 1	2,500		
	Richmond pig No. 2	2,500		
	Soft pig	6,000		
	Remelted pig	14,000		
	Total	30,000		

CHEMICAL ANALYSES AND TENSION TESTS.

CAST IRON FROM WATERTOWN ARSENAL FOUNDRY, AND PIG IRONS.



CAST IRON FROM WATERTOWN ARSENAL FOUNDRY.

No. of test.	Description.	Marks.	Chemical composition.								Tensile strength per square inch.	Fracture.	Specific gravity.	Hardness.
			Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.				
			Total.	Graphitic.	Combined.									
											Pounds.			
5078	12-inch shell	Cast July 1, 1893	3.340	2.440	0.900	0.335	1.187	0.113	0.572	0.000	27,700	Granular, dark streaks	7.1868	16.07
5080	do	Cast Aug. 1, 1893	3.351	2.391	0.960	0.342	1.081	0.134	0.505	0.000	27,990	Granular, mottled	7.2000	15.20
5114	8 and 10 inch shot	Cast Apr. 24, 1894	3.231	2.487	0.744	0.461	1.511	0.118	0.521	0.000	31,980	Fine granular, granitic	7.2150	17.35
5113	Shot iron	Cast Apr. 16, 1894	4.166	3.558	0.608	0.451	1.212	0.125	0.655	0.000	32,400	do		
5090	Cast Oct. 16, 1893	12-inch shell	2.645	2.279	0.366	0.353	1.024	0.118	0.496	0.000	34,450	Granular, mottled		
5091	Cast Oct. 23, 1893	do									26,600	do		
5092	Cast Oct. 28, 1893	do									29,350	do		
5099	Cast Mar. 14, 1894	Upper roller path, 8-inch carriage.	3.231	2.492	0.739	0.448	1.231	0.125	0.816	0.000	32,980	Fine granular, granitic		
5100	do	do	2.825	2.393	0.432	0.450	1.090	0.140	0.497	0.000	31,110	do		
5115	Cast May 15, 1894	8 and 10-inch shot	3.026	2.727	0.299	0.462	1.363	0.125	0.477	0.000	31,810	do	7.1802	15.83
5116	Cast May 11, 1894	Upper roller path, 8-inch carriage.	2.836	2.058	0.778	0.464	1.560	0.115	0.619	0.000	29,100	do	7.3053	20.47
5117	do		2.986	2.255	0.731	0.458	1.297	0.114	0.491	0.000	30,750	do	7.2448	18.09
5119	Cast June 6, 1894	8-inch shot	3.348	2.890	0.458	0.388	1.645	0.105	0.487	0.000	27,320	Fine granular		
5079	Lower roller path, 12-inch gun-lift carriage.	Cast July 21, 1893	3.517	2.538	0.979	0.348	1.316	0.130	0.642	0.000	26,480	Fine granular	7.1895	15.67
5120	12-inch gun-lift carriage	Cast June 15, 1894	3.026	2.770	0.256	0.470	2.444	0.110	0.587	0.000	28,010	do		
5118	12-inch roller path	Cast May 25, 1894	3.108	2.751	0.357	0.435	1.908	0.095	0.420	0.000	29,120	do	7.1495	11.08

5093	Upper roller path, 8-inch carriage.	Cast Nov. 21, 1893	3.272	2.538	0.634	0.355	1.222	0.090	0.766	0.000	28,520	Granular, granitic color	7.2684	21.04
5094	do	Cast Dec. 28, 1893, from cupola.	2.762	2.577	0.185	0.361	1.146	0.115	0.762	0.000	31,020	Fine granular		
5095	do	Cast Feb. 2, 1894, from air furnace.	2.756	2.116	0.640	0.450	1.419	0.125	0.678	0.000	31,140		7.2481	17.44
5096	do	Cast Feb. 2, 1894	3.204	2.825	0.479	0.361	1.062	0.076	0.238	0.000	32,010		7.2458	16.82
5112	Lower roller path	Cast Apr. 13, 1894	3.168	2.481	0.687	0.454	1.175	0.120	0.673	0.000	31,990	Fine granular		

PIG IRONS.

5081	Charcoal pig from Richmond Iron Works.	No. 3	3.322	2.945	0.377	0.729	1.210	0.017	0.336	0.000	29,250	Fine granular		
5082	do	No. 3 X	3.613	3.026	0.587	0.681	1.034	0.029	0.521	0.000	18,600	do		
5083	do	No. 4	3.482	2.983	0.499	0.650	0.900	0.019	0.360	0.000	23,070	Fine granular, dull luster		
5084	do	No. 4 X	3.463	3.166	0.297	0.653	0.940	0.029	0.511	0.000	30,210	Fine granular		
5085	Salisbury pig	No. 3	3.320	2.503	0.817	0.555	0.874	0.072	0.536	0.000	25,990	do		
5086	do	No. 4	2.713	2.304	0.409	0.348	1.833	0.102	0.497	0.000	25,310	Fine granular, dull luster		
5087	do	No. 4 high	3.365	2.555	0.810	0.484	0.846	0.084	0.350	0.000	29,380	Fine granular		
5088	do	do									27,850	Fine granular, dull luster		
5089	do	do									28,900	do		
5097	Charcoal pig		3.850	3.097	0.753	0.193	1.570	0.020	0.352	0.000	22,840	Fine granular, with spots somewhat coarser.	7.1606	14.69
5098	do	Richmond No. 1 / Blue mark	3.804	3.002	0.802	0.200	1.569	0.024	0.326	0.000	24,120	Medium fine granular	7.1783	6.82
5101	Clifton charcoal pig	No. 2	4.267	3.590	0.677	0.748	1.381	0.015	0.223	0.000	15,240	Medium granular		
5102	do	No. 3	4.071	3.449	0.622	0.387	0.517	0.022	0.205	0.000	15,060	Fine granular, with coarse granular patches.		
5103	do	No. 4	3.894	3.176	0.718	0.361	0.500	0.020	0.381	0.000	17,520	Fine granular, with coarse spangles.		
5104	Shelby charcoal pig	No. 2	4.136	3.605	0.531	0.737	0.874	0.035	0.406	0.000	19,970	Fine granular, 20 per cent of surface medium coarse.		
5105	do	No. 3	3.662	3.163	0.499	0.185	0.675	0.040	0.441	0.000	17,980	Fine and medium coarse granulation interspersed.		
5106	do	No. 4	3.735	3.155	0.580	0.451	0.610	0.043	0.467	0.000	16,850	do		
5107	Seneca coke pig	No. 2	4.171	3.558	0.614	0.322	1.269	0.030	0.304	0.000	11,320	From fine to coarse granulation.		
5108	do	No. 3	4.191	3.324	0.867	0.384	0.752	0.036	0.317	0.000	20,650	Medium coarse granulation		
5109	Clove Spring charcoal pig	No. 2	3.905	3.471	0.434	0.479	1.269	0.033	0.443	0.000	14,910	do		
5110	do	No. 3	3.613	3.176	0.437	0.343	1.927	0.025	0.432	0.000	23,990	Medium coarse and fine granulation interspersed.		
5111	do	No. 4	3.272	2.497	0.775	0.472	1.269	0.030	0.425	0.000	27,620	Fine granular		

CHAIN CABLE, CHAIN IRON, SHACKLES, AND SWIVELS.

TENSION TESTS OF CHAIN CABLE, SHACKLES, AND SWIVELS FOR UNITED STATES LIGHT-HOUSE INSPECTOR, THIRD DISTRICT.

TESTS OF CHAIN CABLE.

No. of test.	Marks.	Diameters.		Sectional area of chain.	Tensile strength.		Fractured.
		End links.	Studded links of chain.		Total.	Per square inch.	
		Inches.	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	
6980	Leb. C. Wks., Lebanon, Pa	1.68	1.53	3.68	146,300	39,750	First link of chain in the weld. Fibrous.
6981	do	1.68	1.53	3.68	151,600	41,190	First link of chain in the quarter. Fibrous.
6982	do	1.67	1.54	3.72	139,900	37,610	Middle link of chain in the weld. Fibrous.
6977	do	1.82	1.77	4.92	122,200	37,030	First link of chain in the weld. Fibrous.
6978	do	1.92	1.78	4.98	212,100	42,590	Middle link of chain in the weld. Fibrous.
6979	do	1.91	1.78	4.98	210,100	42,190	First link of chain in the weld. Fibrous.
7004	do		1.77	4.92	186,800	37,970	Do.
7005	do		1.78	4.98	161,100	32,350	Do.
7006	do		1.76	4.87	192,200	39,470	Do.
6974	do	2.20	2.03	6.47	274,300	42,400	First link of chain in the quarter. Fibrous.
6975	do	2.17	2.03	6.47	270,050	41,740	Do.
6976	do	2.17	2.02	6.41	243,300	37,960	Middle link in the quarter. Fibrous, 60 per cent; granular, 40 per cent.
6990	W. E. R. M. Co. Lebanon, Pa	2.24	2.07	6.73	220,100	32,700	End link in the weld. Fibrous, 70 per cent; granular, 30 per cent.
6990a	W. E. R. M. Co. Lebanon, Pa				229,000	34,030	First link of chain in the weld. Fibrous, 70 per cent; granular, 30 per cent.
6991	do	2.24	2.03	6.47	228,900	35,370	End link in the weld. Fibrous, 10 per cent; granular, 90 per cent.
6991a	do				229,200	35,420	First link of chain in the weld.
7001	Leb. C. Wks. Lebanon, Pa		2.01	6.35	261,500	41,180	First link in the quarter at welded end. Fibrous.
7002	do		2.02	6.41	260,900	40,700	Middle link in the quarter at welded end. Fibrous.
7003	do		2.01	6.35	248,200	39,090	First link in the quarter. Fibrous.
7120	do		2.03	6.47	262,800	40,620	Do.
7121	do		2.03	6.47	261,900	40,480	Middle link in the quarter. Fibrous.
7122	do		2.03	6.47	256,200	39,600	First link in the quarter. Fibrous.

TESTS OF SHACKLES AND SWIVELS.

No. of test.	Description.	Tensile strength.	Fractured.
		Pounds.	
6987	1⅛" shackle	205,400	Across eye carrying tongue. Fibrous.
6985	1½" shackle	274,300	Bale of shackle. Fibrous.
6983	2" shackle	351,900	Tongue of shackle.
6887	do	277,100	Bale of shackle on one side. Fibrous.
6888	do	274,400	Do.
6889	do	308,100	Do.
6886	2⅛" shackle	317,200	Bale of shackle on one side; 60 per cent granular, 40 per cent fibrous.
6884	2¼" shackle	339,100	Bale of shackle [illegible]. One part fibrous, one part granular.
6885	do	330,300	Bale of shackle. Both parts granular.
6988	1½" swivel	171,900	Eye of male part. Fibrous.
6986	1¾" swivel	139,900	Eye of male part. Granular, varying from coarse to fine.
6896	do	185,200	Eye of male part. Fibrous.
6897	do	186,700	Pulled off head of male part. Granular.
6898	2" swivel	148,600	2" end link in the weld. Swivel uninjured.
		261,400	At scarf of weld in the bale; the line of fracture followed the scarf.
6964	do	186,200	Bale of swivel; separated along the scarf weld.
7166	do	219,900	Bale of swivel; followed scarf of weld; 60 per cent of surface had a dull, smooth appearance, and 40 per cent fibrous.

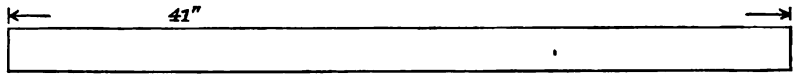
TENSION TESTS OF CHAIN CABLE AND CHAIN IRON FROM THE BOSTON NAVY-YARD.

TESTS OF CHAIN CABLE.

No. of Test.	Marks.	Diameters.		Sectional area of chain.	Tensile strength.		Fractured.
		End links.	Studded links of chain.		Total.	Per square inch.	
		In.	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	
6481	N. S. N. Y. B. 1....	2.72	2.52	9.97	359,200	36,030	First studded link in the quarter. Granular. In part separated along scarf of weld.
6482	N. S. N. Y. B. 11...	2.73	2.52	9.97	369,100	37,020	End link. Pulled out piece between the two quarters. Granular 40 per cent.
6482 *a*[1]	.....do.....	3.00	.....	.....	342,100	34,310	First studded link in the quarter. Granular.
7284	N. S. N. Y. B.....	2.75	2.54	10.13	378,800	37,390	Middle link at the welded end. The metal in part separated along the scarf of the weld, and in part through the iron.

[1] Retest of studded links of No. 6482 after having been fitted with new end links. Interval between two tests, seven days.

TESTS OF CHAIN IRON.



No. of test.	Mark on specimen.	Diameter.	Sectional area.	Elastic limit.		Ultimate strength.		Elongation in 8 inches.		Area at fracture.	Contraction of area.	Appearance of fracture.	Elongation of 1-inch sections.
				Total	Per square inch.	Total	Per square inch.						
		Inches.	*Sq. inch.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Inches.*	*Per ct.*	*Inch. Sq. in.*	*Per ct.*		″ ″ ″ ″ ″ ″ ″ ″
6483	A1	2.52	4.99	136,500	27,350	229,400	45,970	3.53	44.1	Diam. 1.83 = 2.63	47.3	Fibrous.....	.33, .36, .34, .49, .82*, .48, .38, .33
6484	A5	2.51	4.95	128,100	25,880	225,740	45,600	3.08	37.6	Diam. 1.81 = 2.57	48.1	.....do.....	.29, .25, .38, .80*, .51, .32, .27, .26

CHAINS.

PROOF STRESSES.

CHAINS.—PROOF STRESSES.

Proof stresses applied to 15-inch gun-lift chains, manufactured at the Watertown Arsenal, Mass.

Details of tests of breech chains.

Made of iron 1 inch diameter, with end links 1⅛ inches diameter.

Samples have 42 links, not including end links.

The lengths of chain given are the lengths under 2,000 pounds, center to center of 3-inch pins in end links.

Lengths.	126″.	125″.7.	126″.	125″.5.
Applied loads.	Elongations under stress.			
	No. 6288.	No. 6289.	No. 6290.	No. 6291.
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*
2,000	0.	0.	0.	0.
4,000	.17	.12	.13	.14
6,000	.31	.26	.26	.27
8,000	.46	.40	.39	.40
10,000	.61	.53	.51	.53
12,000	.74	.70	.64	.67
14,000	.90	.91	.83	.87
15,000	1.03	1.10	1.00	1.00
16,000	1.20	1.37	1.25	1.20
17,000	1.47	1.75	1.52	1.45
18,000	1.72	2.10	1.88	1.90
19,000	2.10	2.60	2.42	2.35
20,000	2.64	3.19	3.02	2.99
2,000	2.41	2.92	2.76	2.73

Details of tests of muzzle chains.

Made of iron ⅞ inch diameter, with end links 1 inch diameter.

Samples have 35 links, not including end links.

The lengths of chain given are the lengths under 2,000 pounds, center to center of 2½-inch pins in end links.

Lengths.	97″.1.	98″.	97″.4.	97″.7.	98″.25.
Applied loads.	Elongations under stress.				
	No. 6292.	No. 6293.	No. 6294.	No. 6295.	No. 6296.
Pounds.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
2,000	0.	0.	0.	0.	0.
4,000	.03	.09	.20	.15	.16
6,000	.10	.21	.37	.29	.32
8,000	.22	.31	.50	.40	.48
9,000	.29	.39	.58	.48	.56
10,000	.38	.45	.65	.55	.64
11,000	.51	.50	.72	.68	.76
12,000	.78	.60	.82	.89	.93
13,000	1.15	.77	.98	1.19	1.30
14,000	1.60	1.10	1.20	1.60	1.82
15,000	2.15	1.57	1.71	2.09	2.43
2,000	2.00	1.40	1.56	1.93	2.27

BRASS AND BRONZE.

BRASS FOR CONSOLE.

Cast at Watertown Arsenal in dry sand. Samples from gate of casting.

Mixture....
- Copper.....per cent.. 55
- Zinc .....do.... 44
- Tin .....do.... 1

No. 5196.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000333	.000333	0.	.....	
2,500	10,000	.000867	.000534	0.	.....	
3,750	15,000	.001433	.000566	0.	.....	
4,000	16,000	.001533	.000100	.....	.....	
4,250	17,000	.001633	.000100	.....	.....	Elastic limit.
4,500	18,000	.001967	.000334	.....	.....	
4,750	19,000	.002300	.000333	.....	.....	
5,000	20,000	.002567	.000267	.000333	.000333	
5,250	21,000	.002867	.000300	.....	.....	
5,500	22,000	.003067	.000200	.....	.....	
5,750	23,000	.003400	.000333	.....	.....	
6,000	24,000	.004033	.000633	.....	.....	
6,250	25,000	.004567	.000534	.....	.....	
6,500	26,000	.005267	.000700	.....	.....	
6,750	27,000	.006000	.000733	.....	.....	
7,000	28,000	.007433	.001433	.....	.....	
7,250	29,000	.008467	.001034	.....	.....	
7,500	30,000	.010700	.002233	.....	.....	
7,750	31,000	.011333	.000633	.....	.....	
8,000	32,000	.014333	.003000	.....	.....	
8,250	33,000	.015833	.001500	.....	.....	
8,500	34,000	.020067	.004234	.....	.....	
8,750	35,000	.021767	.001700	.....	.....	
9,000	36,000	.0267	.004933	.....	.....	
9,250	37,000	.0300	.0033	.....	.....	
9,480	37,920	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	37,920
Elastic limit per square inch of original section	do...	17,000
Elongation per inch after rupture	inch..	.0400
Elongation per inch under strain at elastic limit	do...	.001633
Reduction in diameter at point of rupture	do...	.034
Reduction in area after rupture, per cent of original section		11.6
Position of rupture		″.9 from neck
Character of broken surface		60 per cent light yellow, 40 per cent lavender color
Elongation of inch sections		″.02, ″.02, ″.08*

No. 5197.

DUPLICATE OF No. 5196.

Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 3″.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
1,250	5,000	.000333	.000333	.....	.....	
2,500	10,000	.000733	.000400	.....	.....	
3,750	15,000	.001167	.000434	.....	.....	
4,000	16,000	.001267	.000100	.....	.....	
4,250	17,000	.001333	.000066	.....	.....	
4,500	18,000	.001500	.000167	.....	.....	
4,750	19,000	.001633	.000133	.....	.....	
5,000	20,000	.001800	.000167	.000100	.000100	
5,250	21,000	.002000	.000200	.....	.....	
5,500	22,000	.002200	.000200	.....	.....	Elastic limit.
5,750	23,000	.002567	.000367	.....	.....	
6,000	24,000	.002833	.000266	.....	.....	
6,250	25,000	.003067	.000234	.....	.....	
6,500	26,000	.003400	.000333	.....	.....	
6,750	27,000	.003867	.000467	.....	.....	
7,000	28,000	.004533	.000666	.....	.....	
7,250	29,000	.005033	.000500	.....	.....	
7,500	30,000	.006000	.000967	.....	.....	
7,750	31,000	.006800	.000800	.....	.....	
8,000	32,000	.008133	.001333	.....	.....	
8,250	33,000	.009200	.001067	.....	.....	
8,500	34,000	.011333	.002133	.....	.....	
8,750	35,000	.012833	.001500	.....	.....	
9,000	36,000	.015000	.002167	.....	.....	
9,250	37,000	.016967	.001967	.....	.....	
9,500	38,000	.020000	.003033	.....	.....	
9,750	39,000	.022000	.002000	.....	.....	
10,000	40,000	.025667	.003667	.....	.....	
10,250	41,000	.027833	.002166	.....	.....	
10,475	41,900	.0333	.005467	.....	.....	Tensile strength.

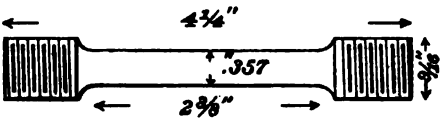
General summary.

Tensile strength per square inch of original section	pounds..	41,900
Elastic limit per square inch of original section	do...	22,000
Elongation per inch after rupture	inch..	.4670
Elongation per inch under strain at elastic limit	do...	.002200
Reduction in diameter at point of rupture	do...	.034
Reduction in area after rupture, per cent of original section		11.6
Position of rupture		at middle of stem
Character of broken surface		lavender color, with light yellow metal interspersed
Elongation of inch sections		″.02, ″.09, ″.03

METAL FOR 3-INCH SABOT, EUREKA SHELL.

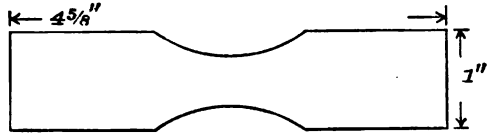
Composition .... { Cu .....per cent.. 75
Zn .....do.... 25

No. 6472.



Sectional area, .10 square inch.
Elastic limit, 685 pounds = 6,850 pounds per square inch.
Tensile strength, 2,514 pounds = 25,140 pounds per square inch.
Elongation in 2 inches, ".67 = 33.5 per cent.
Elongation of inch sections, ".32*, ".35.
Diameter at fracture, ".30; area, .071 square inch.
Contraction of area, 29.0 per cent.
Appearance of fracture, uniform lemon-yellow color.

CARTRIDGE METAL.



No. of test.	Description.	Marks.	Dimensions.		Sectional area.	Tensile strength.		Area at fracture.	Contraction of area.
			Width.	Thickness.		Total.	Per square inch.		
			Inch.	*Inch.*	*Sq. inch.*	*Pounds.*	*Pounds.*	" " *Sq. in.*	*Per cent.*
6473	Aluminum bronze, annealed	1	.50	.0914	.0457	2,590	56,890	.34×.05=.0170	62.8
6474	....do	2	.50	.0915	.0458	2,636	57,550	.34×.05=.0170	62.9
6475	Aluminum bronze, unannealed	3	.50	.0916	.0458	2,667	58,230	.38×.06=.0228	50.2
6476	....do	4	.50	.0915	.0458	2,678	58,470	.37×.05=.0185	59.6
6477	Regular .45-caliber cartridge brass, annealed	5	.50	.0933	.0467	2,138	45,780	.34×.05=.0170	63.6
6478	....do	6	.50	.0932	.0466	2,165	46,460	.34×.05=.0170	63.5
6479	Regular .45-caliber cartridge brass, unannealed	7	.50	.0916	.0458	2,026	44,240	.42×.05=.0210	54.1
6480	....do	8	.50	.0926	.0463	2,166	46,780	.42×.05=.0210	54.6

BRONZE CYLINDER CAST WITH THE CYLINDER HEAD OF KRUPP SPRING-RETURN MORTAR CARRIAGE.

Mixture....
- Copper.....per cent.. 55
- Tin.....do.... 44.5
- Zinc.....do.... 0.5

No. 4924.

Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
500	2,000	.000100	.000100	.....	.....	
750	3,000	.000167	.000067	.....	.....	
1,000	4,000	.000267	.000100	.....	.....	
1,250	5,000	.000333	.000066	0.	.....	
1,500	6,000	.000433	.000100	.....	.....	
1,750	7,000	.000533	.000100	.....	.....	
2,000	8,000	.000633	.000100	.....	.....	
2,250	9,000	.000700	.000067	.....	.....	
2,500	10,000	.000900	.000200	.000067	.000067	
2,750	11,000	.001033	.000133	.....	.....	Elastic limit.
3,000	12,000	.001267	.000234	.....	.....	
3,250	13,000	.001400	.000133	.....	.....	
3,500	14,000	.001700	.000300	.....	.....	
3,750	15,000	.001967	.000267	.000633	.000566	
4,000	16,000	.002300	.000333	.....	.....	
4,250	17,000	.002600	.000300	.....	.....	
4,500	18,000	.003167	.000567	.....	.....	
4,750	19,000	.003633	.000466	.....	.....	
5,000	20,000	.004167	.000534	.002067	.001434	
5,250	21,000	.004533	.000366	.....	.....	
5,500	22,000	.005367	.000834	.....	.....	
5,750	23,000	.006000	.000633	.....	.....	
6,000	24,000	.007167	.001167	.....	.....	
6,250	25,000	.008500	.001333	.....	.....	
6,500	26,000	.010167	.001667	.....	.....	
7,000	28,000	.015667	.005500	.....	.....	
7,500	30,000	.019333	.003666	.....	.....	
8,000	32,000	.027000	.007667	.....	.....	
8,260	33,040	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	33,040
Elastic limit per square inch of original section	do...	11,000
Elongation per inch after rupture	inch..	.0433
Elongation per inch under strain at elastic limit	do...	.001033
Reduction in diameter at point of rupture	do...	.024
Reduction in area after rupture, per cent of original section		8.4
Position of rupture		1".73 from neck
Character of broken surface.. color variable in spots from a light yellow to a light shade of lavender		
Elongation of inch sections		".03, ".08*, ".20

No. 4924*a*.

Specimen from runner of bronze as above described.
Diameter, ".564.
Sectional area, .25 square inch.
Tensile strength, 2,990 pounds = 11,960 pounds per square inch.
Appearance of fracture, light-yellow color, spongy. Before testing; the specimen showed spongy metal near one end. Fracture occurred at that place.

BRONZE FROM WATERTOWN ARSENAL FOUNDRY.

Composition....	Cu	per cent..	88
	Sn	do....	8
	Zn	do....	4

No. 5202.

Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	0.	0.	Initial load.
500	2,000	.000133	.000132	.....	.....	
750	3,000	.000267	.000134	.....	.....	
1,000	4,000	.000400	.000133	.....	.....	
1,250	5,000	.000567	.000167	.000100	.000100	
1,500	6,000	.000667	.000100	.....	.....	
1,750	7,000	.000733	.000066	.....	.....	
2,000	8,000	.000867	.000134	.....	.....	
2,250	9,000	.001000	.000133	.....	.....	
2,500	10,000	.001167	.000167	.000233	.000133	
2,750	11,000	.001233	.000066	.....	.....	
3,000	12,000	.001333	.000100	.....	.....	Elastic limit.
3,250	13,000	.001567	.000234	.....	.....	
3,500	14,000	.001867	.000300	.....	.....	
3,750	15,000	.002233	.000366	.000900	.000667	
4,000	16,000	.003300	.001067	.....	.....	
4,250	17,000	.004100	.000800	.....	.....	
4,500	18,000	.005667	.001567	.....	.....	
4,750	19,000	.008667	.003000	.....	.....	
5,000	20,000	.011967	.003300	.010000	.009100	
5,500	22,000	.0233	.011333	.....	.....	
6,000	24,000	.0400	.0167	.....	.....	
6,500	26,000	.0567	.0167	.....	.....	
7,000	28,000	.0800	.0233	.....	.....	
7,500	30,000	.1067	.0267	.....	.....	
8,000	32,000	.1267	.0200	.....	.....	
8,500	34,000	.1633	.0366	.....	.....	
9,000	36,000	.2000	.0367	.....	.....	
9,160	36,640	.....	.....	.....	.....	Tensile strength.

General summary.

Tensile strength per square inch of original section	pounds..	36,640
Elastic limit per square inch of original section	do...	12,000
Elongation per inch after rupture	inch..	.2167
Elongation per inch under strain at elastic limit	do...	.001333
Reduction in diameter at point of rupture	do...	.064
Reduction in area after rupture, per cent of original section		27.6
Position of rupture		".13 from neck
Character of broken surface		uniform light yellow
Elongation of inch sections		".27", ".20, ".18

COPPERS FOR USE IN PRESSURE GAUGES.

CURVES OF PRESSURES FOR

$\frac{1}{30}$ SQ. INCH AND $\frac{1}{10}$ SQ. INCH GAUGES.

COPPERS FOR USE IN PRESSURE GAUGES.

CURVES OF PRESSURE FOR $\frac{1}{30}$ SQUARE INCH AND $\frac{1}{10}$ SQUARE INCH GAUGES.

No. 6297.

Copper cylinders from lot of copper purchased October, 1893. Mean compression of ten cylinders.

Table for use with crusher gauge $\frac{1}{30}$ square inch area.

Mean dimensions of coppers: Length, ".4996; diameter, ".2054.

Load per square inch on crusher gauge, $\frac{1}{30}$ square inch area.	Total compression.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
3,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6,000	.0001	.0001	.0002	.0001	.0001	.0003	.0002	.0001	.0002	.0005	.0002	.0002
9,000	.0006	.0002	.0004	.0002	.0002	.0006	.0003	.0003	.0007	.0007	.0004	.0003
10,000												.0005
11,000												.0008
12,000	.0017	.0010	.0010	.0018	.0004	.0020	.0005	.0015	.0021	.0015	.0014	.0013
13,000												.0021
14,000												.0034
15,000	.0065	.0055	.0052	.0060	.0050	.0060	.0017	.0060	.0068	.0065	.0057	.0055
16,000	.0075	.0066	.0060	.0085	.0065	.0070	.0035	.0072	.0079	.0070	.0068	.0065
17,000	.0091	.0097	.0080	.0095	.0080	.0102	.0063	.0096	.0097	.0078	.0078	.0074
18,000	.0125	.0104	.0095	.0120	.0102	.0112	.0070	.0103	.0125	.0105	.0106	.0102
19,000	.0130	.0120	.0115	.0130	.0115	.0132	.0090	.0120	.0135	.0125	.0121	.0117
20,000	.0148	.0140	.0135	.0155	.0135	.0155	.0106	.0144	.0150	.0135	.0140	.0135
21,000	.0167	.0160	.0150	.0169	.0160	.0170	.0125	.0160	.0175	.0165	.0160	.0155
22,000	.0192	.0178	.0176	.0190	.0168	.0191	.0145	.0182	.0191	.0175	.0179	.0174
23,000	.0205	.0195	.0195	.0211	.0195	.0215	.0160	.0192	.0220	.0205	.0199	.0193
24,000	.0225	.0220	.0211	.0230	.0208	.0230	.0184	.0224	.0243	.0220	.0219	.0213
25,000	.0235	.0246	.0226	.0250	.0230	.0245	.0200	.0234	.0250	.0242	.0236	.0229
26,000	.0265	.0252	.0250	.0276	.0255	.0270	.0218	.0252	.0270	.0255	.0256	.0249
27,000	.0286	.0278	.0265	.0291	.0270	.0296	.0233	.0273	.0297	.0280	.0277	.0269
28,000	.0309	.0303	.0285	.0308	.0293	.0310	.0260	.0300	.0320	.0307	.0300	.0292
29,000	.0331	.0325	.0310	.0335	.0310	.0335	.0287	.0320	.0346	.0330	.0323	.0314
30,000	.0355	.0341	.0338	.0355	.0328	.0361	.0310	.0338	.0365	.0345	.0344	.0335
31,000	.0375	.0365	.0352	.0380	.0356	.0376	.0335	.0360	.0380	.0370	.0365	.0355
32,000	.0397	.0386	.0378	.0401	.0376	.0415	.0350	.0390	.0405	.0385	.0388	.0378
33,000	.0425	.0418	.0395	.0430	.0401	.0425	.0375	.0397	.0426	.0410	.0410	.0400
34,000	.0444	.0430	.0413	.0450	.0430	.0455	.0390	.0430	.0455	.0440	.0437	.0426
35,000	.0468	.0459	.0435	.0470	.0445	.0470	.0415	.0445	.0475	.0460	.0454	.0443
36,000	.0489	.0477	.0470	.0497	.0477	.0498	.0436	.0478	.0497	.0480	.0480	.0469
37,000	.0513	.0498	.0486	.0520	.0495	.0525	.0574	.0594	.0518	.0505	.0503	.0492
38,000	.0538	.0520	.0513	.0532	.0520	.0548	.0491	.0520	.0545	.0525	.0525	.0514
39,000	.0567	.0555	.0534	.0564	.0545	.0570	.0513	.0533	.0566	.0560	.0551	.0540
40,000	.0586	.0594	.0553	.0586	.0570	.0591	.0533	.0562	.0595	.0580	.0575	.0564
41,000	.0611	.0604	.0585	.0617	.0581	.0618	.0560	.0593	.0615	.0595	.0598	.0587
42,000	.0634	.0623	.0604	.0640	.0620	.0658	.0580	.0620	.0636	.0620	.0624	.0613
43,000	.0664	.0654	.0633	.0663	.0636	.0678	.0602	.0633	.0660	.0638	.0646	.0635
44,000	.0689	.0686	.0670	.0691	.0664	.0697	.0627	.0665	.0685	.0675	.0675	.0664
45,000	.0715	.0691	.0686	.0720	.0684	.0720	.0654	.0690	.0720	.0695	.0698	.0687
46,000	.0735	.0729	.0710	.0745	.0710	.0750	.0680	.0715	.0750	.0730	.0725	.0714
47,000	.0750	.0750	.0723	.0760	.0734	.0775	.0708	.0730	.0765	.0744	.0744	.0732
48,000	.0791	.0760	.0748	.0791	.0761	.0805	.0735	.0760	.0790	.0770	.0772	.0760
49,000	.0815	.0797	.0779	.0819	.0780	.0824	.0752	.0797	.0830	.0810	.0800	.0788
50,000	.0833	.0826	.0820	.0845	.0800	.0850	.0772	.0810	.0840	.0830	.0823	.0811
51,000	.0865	.0854	.0835	.0875	.0845	.0880	.0808	.0834	.0865	.0850	.0851	.0839
52,000	.0894	.0879	.0852	.0893	.0855	.0895	.0845	.0860	.0890	.0868	.0873	.0861
53,000	.0910	.0902	.0885	.0925	.0873	.0930	.0860	.0890	.0920	.0904	.0900	.0888
54,000	.0938	.0938	.0913	.0956	.0910	.0958	.0875	.0920	.0955	.0925	.0927	.0915
55,000	.0959	.0960	.0930	.0980	.0930	.0975	.0896	.0940	.0970	.0950	.0949	.0937
56,000	.0984	.0978	.0960	.1000	.0962	.1013	.0925	.0963	.0994	.0980	.0976	.0964
57,000	.1020	.1000	.0980	.1030	.0989	.1034	.0960	.0991	.1025	.1010	.1004	.0992
58,000	.1041	.1032	.1010	.1055	.1015	.1055	.0990	.1015	.1060	.1030	.1030	.1018
59,000	.1070	.1050	.1040	.1075	.1045	.1080	.1015	.1060	.1083	.1070	.1059	.1046
60,000	.1098	.1075	.1060	.1110	.1065	.1110	.1035	.1076	.1109	.1086	.1082	.1069
61,000	.1120	.1105	.1085	.1125	.1088	.1140	.1065	.1090	.1135	.1098	.1105	.1092

No. 6297—Continued.

Load per square inch on crusher gauge, $\frac{1}{10}$ square inch area.	Total compression.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
62,000	.1148	.1140	.1113	.1147	.1105	.1165	.1079	.1120	.1170	.1135	.1132	.1119
63,000	.1165	.1165	.1149	.1191	.1138	.1184	.1100	.1146	.1200	.1165	.1160	.1147
64,000	.1195	.1185	.1166	.1205	.1165	.1215	.1138	.1175	.1215	.1186	.1185	.1172
65,000	.1215	.1216	.1192	.1225	.1185	.1247	.1165	.1205	.1253	.1210	.1211	.1198
66,000	.1250	.1247	.1225	.1260	.1215	.1270	.1180	.1230	.1280	.1235	.1239	.1226
67,000	.1275	.1259	.1240	.1289	.1239	.1290	.1210	.1249	.1323	.1265	.1264	.1251
68,000	.1293	.1288	.1265	.1304	.1252	.1325	.1231	.1276	.1332	.1290	.1286	.1272
69,000	.1325	.1320	.1280	.1343	.1285	.1338	.1258	.1306	.1365	.1310	.1313	.1299
70,000	.1370	.1350	.1305	.1365	.1310	.1358	.1279	.1325	.1410	.1350	.1342	.1328
71,000	.1380	.1359	.1346	.1384	.1329	.1395	.1308	.1355	.1434	.1385	.1368	.1354
72,000	.1401	.1389	.1365	.1415	.1380	.1420	.1338	.1375	.1470	.1397	.1395	.1381
73,000	.1426	.1410	.1407	.1443	.1392	.1437	.1356	.1397	.1505	.1425	.1420	.1406
74,000	.1449	.1449	.1420	.1465	.1415	.1475	.1380	.1429	.1540	.1445	.1449	.1435
75,000	.1470	.1470	.1445	.1490	.1443	.1503	.1405	.1455	.1565	.1465	.1471	.1457
76,000	.1500	.1488	.1465	.1520	.1460	.1526	.1436	.1479	.1620	.1510	.1500	.1486
77,000	.1521	.1515	.1489	.1544	.1505	.1565	.1457	.1502	.1675	.1515	.1529	.1515
78,000	.1555	.1542	.1520	.1566	.1517	.1584	.1481	.1535	.1695	.1555	.1555	.1541
79,000	.1585	.1562	.1546	.1595	.1540	.1616	.1508	.1553	.1725	.1580	.1581	.1567
80,000	.1605	.1589	.1590	.1608	.1570	.1645	.1535	.1580	.1765	.1607	.1609	.1595
81,000	.1628	.1620	.1600	.1638	.1593	.1670	.1560	.1610	.1805	.1630	.1635	.1621
82,000	.1652	.1640	.1615	.1674	.1620	.1696	.1582	.1630	.1845	.1658	.1661	.1647
83,000	.1680	.1660	.1642	.1699	.1640	.1735	.1610	.1660	.1886	.1680	.1689	.1675
84,000	.1704	.1679	.1670	.1724	.1665	.1764	.1640	.1684	.1928	.1718	.1718	.1704
85,000	.1730	.1705	.1698	.1738	.1690	.1790	.1660	.1710	.1980	.1735	.1744	.1730
86,000	.1736	.1735	.1729	.1770	.1704	.1827	.1689	.1740	.2015	.1770	.1772	.1758
87,000	.1770	.1760	.1760	.1800	.1741	.1868	.1705	.1775	.2038	.1805	.1802	.1788
88,000	.1792	.1778	.1770	.1820	.1760	.1891	.1736	.1786	.2088	.1860	.1828	.1814
89,000	.1820	.1810	.1791	.1840	.1787	.1925	.1757	.1820	.2120	.1875	.1855	.1841
90,000	.1847	.1828	.1815	.1875	.1815	.1940	.1789	.1840	.2190	.1880	.1882	.1868
91,000	.1869	.1847	.1836	.1895	.1839	.1966	.1806	.1859	.2210	.1890	.1902	.1888
92,000	.1887	.1870	.1865	.1945	.1854	.2015	.1824	.1890	.2248	.1910	.1931	.1917
93,000	.1920	.1895	.1896	.1955	.1880	.2036	.1847	.1920	.2292	.1945	.1959	.1945
94,000	.1950	.1920	.1920	.1960	.1906	.2054	.1870	.1935	.2300	.2000	.1982	.1968
95,000	.1960	.1935	.1945	.1970	.1940	.2084	.1895	.1955	.2320	.2025	.2003	.1989
96,000	.1975	.1962	.1970	.2010	.1985	.2115	.1911	.1997	.2363	.2030	.2032	.2018
97,000	.2005	.1997	.1990	.2035	.1991	.2155	.1945	.2012	.2380	.2070	.2058	.2044
98,000	.2026	.2010	.2025	.2055	.1995	.2165	.1975	.2033	.2407	.2089	.2078	.2064
99,000	.2048	.2032	.2040	.2074	.2005	.2186	.1990	.2055	.2440	.2100	.2097	.2083
100,000	.2070	.2052	.2054	.2100	.2022	.2225	.2007	.2078	.2459	.2120	.2119	.2105

No. 6298.

Copper cylinders from same lot of copper as No. 6297. Mean compression of ten cylinders.

Table for use with crusher gauge, $\frac{1}{10}$ square inch area.

Mean dimensions of coppers: Length, ".4996; diameter, ".2518.

Load per square inch on crusher gauge, $\frac{1}{10}$ square inch area.	Total compression.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
3,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6,000	.0018	.0015	.0040	.0025	.0011	.0002	.0030	.0025	.0030	.0026	.0022	.0020
9,000	.0093	.0120	.0148	.0147	.0108	.0060	.0165	.0145	.0141	.0140	.0126	.0121
10,000												.0161
11,000												.0202
12,000	.0240	.0240	.0265	.0246	.0228	.0205	.0270	.0288	.0260	.0260	.0250	.0243
13,000												.0281
14,000												.0318
15,000	.0363	.0375	.0400	.0340	.0356	.0336	.0302	.0395	.0395	.0390	.0365	.0355
16,000	.0401	.0395	.0421	.0409	.0370	.0355	.0420	.0430	.0420	.0417	.0404	.0393
17,000	.0445	.0455	.0475	.0461	.0430	.0400	.0475	.0475	.0465	.0470	.0455	.0444
18,000	.0490	.0500	.0520	.0506	.0470	.0447	.0525	.0525	.0510	.0510	.0500	.0489
19,000	.0540	.0537	.0564	.0560	.0525	.0497	.0560	.0565	.0560	.0560	.0547	.0536
20,000	.0586	.0590	.0615	.0602	.0560	.0538	.0613	.0615	.0607	.0607	.0593	.0582
21,000	.0628	.0630	.0660	.0637	.0606	.0595	.0658	.0665	.0650	.0651	.0637	.0626
22,000	.0683	.0695	.0710	.0701	.0655	.0638	.0709	.0716	.0707	.0705	.0692	.0681
23,000	.0728	.0735	.0758	.0740	.0700	.0696	.0750	.0759	.0745	.0748	.0736	.0725
24,000	.0778	.0785	.0796	.0791	.0750	.0740	.0800	.0815	.0800	.0790	.0785	.0773
25,000	.0832	.0832	.0865	.0840	.0805	.0785	.0836	.0855	.0840	.0859	.0833	.0821
26,000	.0881	.0879	.0920	.0892	.0855	.0840	.0902	.0911	.0897	.0900	.0888	.0876
27,000	.0935	.0943	.0965	.0944	.0905	.0895	.0949	.0956	.0951	.0955	.0940	.0928
28,000	.0983	.0987	.1007	.0995	.0960	.0940	.1000	.1007	.0996	.1001	.0988	.0976
29,000	.1035	.1035	.1062	.1045	.1002	.0995	.1055	.1056	.1050	.1060	.1040	.1028
30,000	.1090	.1090	.1121	.1100	.1045	.1040	.1096	.1115	.1108	.1099	.1090	.1077
31,000	.1138	.1138	.1168	.1138	.1115	.1095	.1150	.1165	.1147	.1150	.1140	.1127
32,000	.1190	.1185	.1226	.1200	.1151	.1150	.1197	.1220	.1200	.1200	.1191	.1178
33,000	.1235	.1235	.1265	.1240	.1213	.1200	.1235	.1260	.1252	.1260	.1240	.1227
34,000	.1294	.1286	.1325	.1300	.1260	.1255	.1305	.1318	.1305	.1310	.1296	.1283
35,000	.1336	.1343	.1370	.1350	.1312	.1302	.1350	.1365	.1360	.1360	.1345	.1331
36,000	.1395	.1391	.1421	.1398	.1365	.1354	.1405	.1416	.1408	.1415	.1397	.1383
37,000	.1436	.1440	.1485	.1460	.1416	.1405	.1460	.1475	.1465	.1460	.1450	.1436
38,000	.1494	.1496	.1526	.1500	.1465	.1456	.1506	.1520	.1513	.1515	.1499	.1485
39,000	.1550	.1547	.1584	.1550	.1520	.1506	.1555	.1568	.1560	.1570	.1551	.1537
40,000	.1600	.1597	.1634	.1610	.1563	.1555	.1610	.1630	.1610	.1610	.1602	.1588
41,000	.1647	.1648	.1670	.1644	.1615	.1608	.1655	.1660	.1665	.1665	.1648	.1634
42,000	.1696	.1700	.1740	.1705	.1660	.1655	.1710	.1710	.1715	.1710	.1700	.1686
43,000	.1748	.1742	.1773	.1755	.1720	.1705	.1748	.1765	.1760	.1755	.1747	.1733
44,000	.1799	.1791	.1820	.1795	.1762	.1750	.1805	.1808	.1808	.1805	.1794	.1780
45,000	.1843	.1835	.1870	.1853	.1802	.1791	.1852	.1860	.1855	.1860	.1842	.1828
46,000	.1895	.1889	.1915	.1885	.1865	.1845	.1899	.1875	.1908	.1900	.1888	.1874
47,000	.1939	.1931	.1966	.1936	.1906	.1890	.1935	.1955	.1946	.1941	.1935	.1921
48,000	.1990	.1975	.2000	.1981	.1940	.1935	.1990	.1994	.1997	.1997	.1980	.1966
49,000	.2030	.2020	.2047	.2020	.1980	.1990	.2020	.2037	.2040	.2035	.2022	.2008
50,000	.2070	.2061	.2091	.2061	.2040	.2026	.2060	.2080	.2080	.2080	.2065	.2051
51,000	.2105	.2110	.2130	.2095	.2075	.2060	.2120	.2115	.2125	.2120	.2106	.2092
52,000	.2157	.2150	.2176	.2145	.2125	.2113	.2160	.2159	.2170	.2156	.2151	.2137
53,000	.2193	.2186	.2211	.2177	.2155	.2140	.2196	.2201	.2196	.2185	.2184	.2170
54,000	.2250	.2220	.2255	.2218	.2195	.2175	.2240	.2236	.2235	.2225	.2225	.2211
55,000	.2267	.2248	.2284	.2256	.2235	.2211	.2290	.2277	.2278	.2260	.2261	.2247
56,000	.2306	.2295	.2331	.2281	.2275	.2241	.2320	.2313	.2305	.2291	.2296	.2283
57,000	.2335	.2340	.2362	.2320	.2315	.2289	.2345	.2345	.2347	.2330	.2333	.2320
58,000	.2373	.2365	.2400	.2350	.2339	.2323	.2389	.2380	.2375	.2360	.2365	.2352
59,000	.2405	.2405	.2428	.2384	.2375	.2360	.2426	.2414	.2405	.2395	.2400	.2387
60,000	.2448	.2440	.2465	.2425	.2410	.2397	.2450	.2440	.2441	.2425	.2434	.2421
61,000	.2472	.2465	.2496	.2443	.2438	.2420	.2480	.2475	.2465	.2460	.2461	.2448
62,000	.2505	.2505	.2532	.2481	.2465	.2452	.2510	.2505	.2497	.2490	.2494	.2481
63,000	.2545	.2528	.2562	.2511	.2504	.2490	.2545	.2540	.2530	.2525	.2528	.2515
64,000	.2566	.2565	.2580	.2540	.2535	.2530	.2565	.2570	.2560	.2550	.2556	.2543
65,000	.2593	.2590	.2610	.2560	.2562	.2550	.2596	.2586	.2585	.2580	.2579	.2566
66,000	.2625	.2630	.2640	.2590	.2586	.2570	.2620	.2615	.2610	.2605	.2609	.2596
67,000	.2646	.2640	.2665	.2625	.2628	.2600	.2650	.2635	.2632	.2638	.2636	.2623
68,000	.2670	.2670	.2690	.2650	.2640	.2625	.2678	.2660	.2660	.2659	.2660	.2647
69,000	.2695	.2695	.2715	.2668	.2665	.2660	.2704	.2688	.2690	.2681	.2686	.2674
70,000	.2728	.2742	.2740	.2700	.2691	.2678	.2730	.2710	.2702	.2710	.2713	.2701

No. 6298—Continued.

Load per square inch on crusher gauge, $\frac{1}{10}$ square inch area.	Total compression.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
71,000	.2751	.2751	.2761	.2720	.2715	.2700	.2749	.2731	.2731	.2740	.2735	.2723
72,000	.2775	.2770	.2787	.2735	.2732	.2725	.2775	.2756	.2755	.2759	.2757	.2745
73,000	.2798	.2789	.2808	.2766	.2765	.2745	.2805	.2780	.2779	.2779	.2781	.2769
74,000	.2822	.2815	.2830	.2789	.2791	.2765	.2821	.2803	.2805	.2805	.2805	.2793
75,000	.2845	.2840	.2851	.2815	.2805	.2786	.2845	.2825	.2835	.2827	.2827	.2815
76,000	.2866	.2865	.2871	.2835	.2828	.2809	.2870	.2837	.2849	.2847	.2848	.2837
77,000	.2886	.2882	.2896	.2852	.2850	.2835	.2892	.2870	.2860	.2868	.2869	.2858
78,000	.2910	.2905	.2916	.2873	.2870	.2853	.2910	.2889	.2891	.2893	.2891	.2880
79,000	.2930	.2930	.2940	.2897	.2890	.2871	.2930	.2909	.2910	.2906	.2911	.2900
80,000	.2945	.2945	.2955	.2911	.2916	.2898	.2950	.2927	.2930	.2929	.2931	.2920
81,000	.2965	.2968	.2975	.2934	.2925	.2920	.2979	.2938	.2949	.2950	.2950	.2939
82,000	.2982	.2986	.3000	.2955	.2942	.2939	.2990	.2960	.2970	.2971	.2970	.2959
83,000	.3003	.3005	.3010	.2977	.2965	.2960	.3009	.2985	.2989	.2986	.2988	.2977
84,000	.3024	.3023	.3030	.2994	.2984	.2970	.3028	.3005	.3005	.3010	.3007	.2997
85,000	.3039	.3040	.3049	.3011	.3002	.2990	.3050	.3020	.3026	.3029	.3026	.3016
86,000	.3054	.3059	.3065	.3027	.3022	.3010	.3065	.3027	.3032	.3045	.3041	.3031
87,000	.3076	.3075	.3079	.3045	.3040	.3020	.3083	.3050	.3058	.3068	.3059	.3049
88,000	.3090	.3094	.3099	.3060	.3054	.3032	.3105	.3070	.3076	.3080	.3076	.3066
89,000	.3110	.3110	.3118	.3079	.3070	.3059	.3116	.3087	.3094	.3094	.3094	.3084
90,000	.3122	.3128	.3130	.3095	.3089	.3070	.3125	.3103	.3120	.3110	.3109	.3099
91,000	.3136	.3139	.3150	.3114	.3102	.3088	.3140	.3120	.3130	.3125	.3124	.3114
92,000	.3150	.3150	.3165	.3128	.3119	.3102	.3152	.3135	.3143	.3150	.3139	.3130
93,000	.3165	.3175	.3175	.3144	.3135	.3120	.3170	.3149	.3156	.3161	.3155	.3146
94,000	.3183	.3187	.3195	.3155	.3150	.3135	.3185	.3170	.3170	.3177	.3171	.3162
95,000	.3194	.3203	.3205	.3170	.3160	.3150	.3201	.3185	.3188	.3195	.3185	.3176
96,000	.3210	.3215	.3220	.3186	.3175	.3165	.3210	.3200	.3205	.3210	.3200	.3191
97,000	.3221	.3230	.3231	.3199	.3190	.3180	.3223	.3215	.3215	.3226	.3213	.3204
98,000	.3235	.3240	.3250	.3213	.3205	.3195	.3240	.3230	.3230	.3236	.3227	.3218
99,000	.3249	.3255	.3260	.3229	.3224	.3208	.3253	.3244	.3243	.3246	.3241	.3232
100,000	.3256	.3270	.3270	.3245	.3239	.3225	.3265	.3256	.3261	.3265	.3255	.3246

No. 6302.

Copper cylinders from lot received at Sandy Hook,
Mean compression of ten cylinders.
Table for use with crusher gauge, $\frac{1}{10}$ **square inch area.**
Mean dimensions of coppers: Length, ".4996; diameter

Load per square inch on crusher gauge, $\frac{1}{10}$ square inch area.	1.	Total compression. 2.	3.	4.	5.	6.	7.	8.	9.	10.
Pounds.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
3,000	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
6,000	.0080	.0070	.0075	.0079	.0071	.0061	.0095	.0089	.0087	.008
9,000	.0195	.0180	.0180	.0195	.0202	.0190	.0200	.0205	.0170	.019
12,000	.0330	.0305	.0315	.0310	.0318	.0317	.0335	.0330	.0320	.031
15,000	.0439	.0436	.0454	.0440	.0467	.0450	.0461	.0465	.0460	.044
16,000	.0497	.0487	.0490	.0499	.0502	.0485	.0515	.0488	.0481	.049
17,000	.0535	.0532	.0530	.0542	.0555	.0530	.0555	.0545	.0541	.053
18,000	.0590	.0589	.0590	.0584	.0605	.0589	.0605	.0613	.0580	.057
19,000	.0640	.0625	.0625	.0629	.0650	.0634	.0658	.0640	.0630	.063
20,000	.0690	.0675	.0675	.0677	.0695	.0690	.0705	.0690	.0680	.067
21,000	.0736	.0725	.0735	.0735	.0750	.0740	.0755	.0740	.0735	.073
22,000	.0785	.0780	.0780	.0780	.0805	.0800	.0815	.0790	.0782	.078
23,000	.0835	.0837	.0840	.0830	.0860	.0855	.0858	.0846	.0845	.083
24,000	.0885	.0889	.0886	.0885	.0917	.0900	.0916	.0897	.0889	.088
25,000	.0940	.0935	.0940	.0942	.0962	.0950	.0962	.0952	.0944	.094
26,000	.0990	.0993	.0990	.0992	.1018	.1009	.1015	.1004	.0999	.099
27,000	.1046	.1050	.1050	.1050	.1064	.1060	.1080	.1055	.1055	.104
28,000	.1100	.1110	.1102	.1097	.1120	.1124	.1132	.1111	.1117	.110
29,000	.1156	.1162	.1160	.1159	.1180	.1170	.1180	.1170	.1173	.115
30,000	.1210	.1212	.1220	.1218	.1240	.1231	.1238	.1230	.1225	.121
31,000	.1264	.1270	.1280	.1265	.1289	.1278	.1291	.1280	.1274	.126
32,000	.1315	.1334	.1335	.1325	.1342	.1340	.1350	.1350	.1330	.131
33,000	.1375	.1385	.1385	.1379	.1402	.1391	.1403	.1405	.1390	.137
34,000	.1430	.1446	.1442	.1440	.1455	.1454	.1465	.1458	.1446	.143
35,000	.1480	.1497	.1495	.1494	.1520	.1506	.1524	.1515	.1510	.148
36,000	.1540	.1555	.1550	.1543	.1562	.1561	.1568	.1570	.1555	.154
37,000	.1590	.1616	.1602	.1594	.1618	.1618	.1622	.1625	.1610	.159
38,000	.1645	.1660	.1656	.1650	.1667	.1670	.1678	.1675	.1665	.164
39,000	.1694	.1712	.1705	.1701	.1726	.1725	.1732	.1729	.1718	.169
40,000	.1753	.1760	.1754	.1756	.1774	.1770	.1788	.1780	.1775	.175
41,000	.1798	.1820	.1809	.1803	.1834	.1830	.1840	.1835	.1830	.179
42,000	.1850	.1866	.1864	.1844	.1874	.1875	.1878	.1879	.1875	.185
43,000	.1900	.1915	.1910	.1897	.1931	.1925	.1929	.1930	.1925	.190
44,000	.1955	.1962	.1960	.1950	.1980	.1965	.1970	.1972	.1970	.195
45,000	.1995	.2015	.2005	.1994	.2028	.2024	.2020	.2018	.2020	.199
46,000	.2042	.2058	.2054	.2048	.2071	.2069	.2066	.2069	.2079	.204
47,000	.2088	.2105	.2098	.2091	.2120	.2118	.2115	.2120	.2128	.208
48,000	.2135	.2141	.2140	.2135	.2159	.2159	.2155	.2165	.2156	.213
49,000	.2177	.2196	.2185	.2177	.2205	.2205	.2202	.2210	.2198	.217
50,000	.2218	.2235	.2230	.2226	.2245	.2246	.2244	.2245	.2240	.221
51,000	.2272	.2278	.2270	.2268	.2285	.2285	.2285	.2289	.2282	.227
52,000	.2309	.2317	.2313	.2297	.2329	.2325	.2330	.2331	.2327	.230
53,000	.2349	.2355	.2354	.2335	.2375	.2368	.2358	.2363	.2360	.234
54,000	.2380	.2390	.2395	.2371	.2406	.2406	.2396	.2406	.2392	.238
55,000	.2411	.2427	.2432	.2409	.2445	.2445	.2435	.2444	.2432	.241
56,000	.2451	.2465	.2470	.2449	.2475	.2480	.2474	.2478	.2465	.245
57,000	.2487	.2502	.2499	.2480	.2513	.2513	.2510	.2514	.2500	.248
58,000	.2521	.2532	.2534	.2515	.2542	.2539	.2544	.2544	.2537	.252
59,000	.2554	.2565	.2570	.2549	.2575	.2570	.2570	.2575	.2566	.254
60,000	.2588	.2597	.2600	.2579	.2610	.2605	.2597	.2609	.2595	.258
61,000	.2626	.2628	.2630	.2610	.2640	.2634	.2630	.2646	.2625	.262
62,000	.2647	.2656	.2661	.2642	.2668	.2665	.2660	.2672	.2655	.264
63,000	.2664	.2686	.2690	.2670	.2699	.2696	.2694	.2705	.2685	.266
64,000	.2705	.2716	.2718	.2700	.2726	.2714	.2715	.2734	.2716	.270
65,000	.2735	.2745	.2747	.2725	.2750	.2746	.2740	.2752	.2740	.273
66,000	.2758	.2767	.2770	.2751	.2778	.2775	.2765	.2780	.2766	.275
67,000	.2784	.2795	.2795	.2775	.2806	.2804	.2795	.2809	.2795	.278
68,000	.2815	.2820	.2820	.2807	.2831	.2830	.2820	.2833	.2818	.281
69,000	.2835	.2835	.2847	.2830	.2856	.2855	.2846	.2860	.2840	.283
70,000	.2865	.2894	.2870	.2852	.2879	.2878	.2870	.2881	.2866	.286
71,000	.2894	.2915	.2895	.2877	.2903	.2900	.2893	.2905	.2891	.289
72,000	.2920	.2940	.2920	.2903	.2929	.2925	.2915	.2930	.2916	.291
73,000	.2942	.2962	.2961	.2926	.2947	.2945	.2940	.2953	.2938	.293
74,000	.2964	.2985	.2985	.2945	.2969	.2968	.2963	.2975	.2955	.295
75,000	.2985	.3009	.3005	.2965	.2992	.2990	.2985	.2995	.2967	.297
76,000	.3011			.2987	.3020	.3010	.3010	.3015	.3002	.299

No. 6302—Continued.

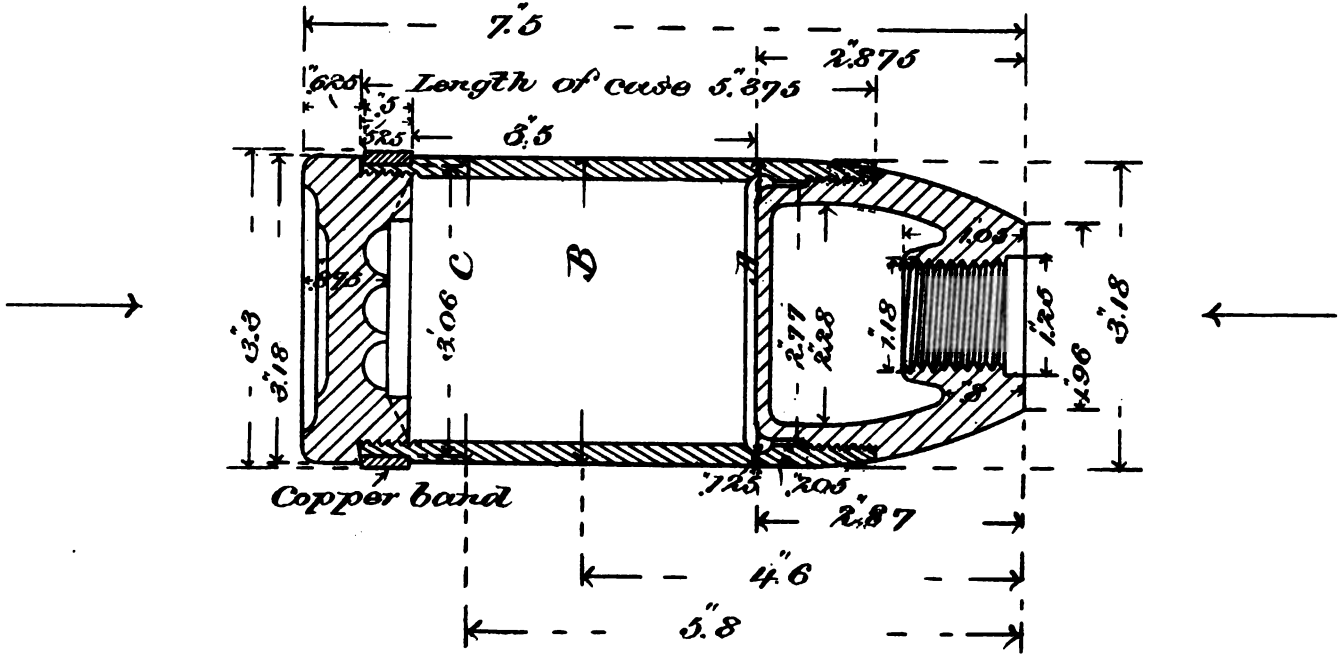
Load per square inch on crusher gauge, ¼ square inch area.	Total compression.											Mean corrected sets.
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	Mean.	
Pounds.	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*
77,000	.3028	.3028	.3027	.3008	.3036	.3031	.3026	.3037	.3026	.3020	.3027	.3016
78,000	.3050	.3047	.3044	.3030	.3055	.3050	.3044	.3056	.3048	.3038	.3046	.3035
79,000	.3070	.3068	.3065	.3049	.3076	.3072	.3065	.3077	.3062	.3055	.3066	.3055
80,000	.3089	.3087	.3087	.3067	.3096	.3093	.3085	.3097	.3084	.3074	.3086	.3075
81,000	.3110	.3106	.3105	.3085	.3114	.3113	.3106	.3115	.3102	.3095	.3105	.3094
82,000	.3125	.3124	.3122	.3106	.3130	.3130	.3128	.3134	.3120	.3114	.3123	.3112
83,000	.3145	.3142	.3138	.3125	.3148	.3146	.3140	.3151	.3135	.3130	.3140	.3129
84,000	.3160	.3157	.3155	.3140	.3165	.3163	.3157	.3168	.3151	.3149	.3156	.3146
85,000	.3179	.3176	.3175	.3157	.3184	.3184	.3176	.3188	.3168	.3165	.3175	.3165
86,000	.3196	.3195	.3194	.3175	.3201	.3200	.3194	.3206	.3187	.3185	.3193	.3183
87,000	.3213	.3212	.3210	.3193	.3218	.3217	.3209	.3223	.3205	.3204	.3210	.3200
88,000	.3229	.3227	.3224	.3210	.3233	.3232	.3226	.3234	.3220	.3218	.3225	.3215
89,000	.3244	.3240	.3238	.3225	.3249	.3248	.3244	.3250	.3235	.3235	.3241	.3231
90,000	.3260	.3258	.3251	.3240	.3265	.3262	.3258	.3261	.3250	.3249	.3255	.3245
91,000	.3275	.3273	.3268	.3255	.3282	.3280	.3272	.3276	.3265	.3265	.3271	.3261
92,000	.3288	.3286	.3285	.3270	.3298	.3295	.3285	.3296	.3281	.3280	.3286	.3277
93,000	.3302	.3302	.3300	.3285	.3313	.3308	.3300	.3311	.3296	.3295	.3301	.3292
94,000	.3319	.3319	.3315	.3300	.3325	.3325	.3315	.3325	.3310	.3310	.3316	.3307
95,000	.3331	.3330	.3328	.3315	.3340	.3337	.3330	.3339	.3325	.3325	.3330	.3321
96,000	.3346	.3343	.3342	.3328	.3355	.3350	.3340	.3352	.3340	.3338	.3343	.3334
97,000	.3356	.3360	.3355	.3340	.3367	.3363	.3352	.3366	.3352	.3350	.3356	.3347
98,000	.3369	.3371	.3370	.3353	.3382	.3376	.3366	.3379	.3364	.3365	.3369	.3360
99,000	.3380	.3385	.3382	.3367	.3395	.3390	.3380	.3392	.3378	.3376	.3382	.3373
100,000	.3393	.3395	.3393	.3378	.3406	.3399	.3390	.3403	.3390	.3390	.3394	.3385

3.2-INCH SHRAPNEL.

STEEL CASE, CAST-IRON GRENADE, AND BASE.

MEASUREMENTS SHOWING ENLARGEMENT OF DIAMETERS UNDER LONGITUDINAL COMPRESSION LOADS.

Shrapnel for 3.2inch B.L. Rifles



H Ex 92 53 3

3.2-INCH SHRAPNEL.

No. 6517.

Compression of shrapnel complete except powder charge.
Branded on base: "Frankford Arsenal 3″.2."
Base chamfered. Load on base received on an annular ring 3″.03 exterior diameter.
Measurements taken on diameters A, B, and C, diameter A being located over the circumferential groove in the inside of the case.
Area of base 3″.2 diameter, 8.04 square inches.
Sectional area of case, full section, 1.91 square inches.
Sectional area of case at circumferential groove, 1.20 square inches.

Applied loads.				Measurements of diameters.		
Total.	Per square inch on 3.2-inch diameter.	Per square inch on full section of case.	Per square inch at circular groove in case.	A.	B.	C.
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Inches.*	*Inches.*	*Inches.*
1,000	124	523	833	3.1791	3.1796	3.1793
15,000	1,866	7,853	12,500	3.1797	3.1803	3.1802
30,000	3,731	15,707	25,000	3.1803	3.1806	3.1803
45,000	5,597	23,560	37,500	3.1812	3.1809	3.1807
60,000	7,463	31,414	50,000	3.1857	3.1813	3.1812
70,000	8,706	36,649	58,333	3.1951	3.1819	3.1817
72,500	9,017	37,958	60,417	3.1977	3.1822	3.1818
75,000	9,328	39,267	62,500	3.2003	3.1825	3.1819
1,000	124	523	833	3.1967	3.1804	3.1806

Test discontinued.

No. 6518.

Compression of shrapnel empty.
Diameters measured at same places as in test No. 6517.

Applied loads.				Measurements of diameters.		
Total.	Per square inch on 3.2-inch diameter.	Per square inch on full section of case.	Per square inch at circular groove in case.	A.	B.	C.
Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Inches.*	*Inches.*	*Inches.*
1,000	124	523	833	3.1798	3.1795	3.1781
15,000	1,866	7,853	12 500	3.1803	3.1799	3.1783
30,000	3,731	15,707	25,000	3.1812	3.1802	3.1787
45,000	5,597	23,560	37,500	3.1827	3.1804	3.1789
60,000	7,463	31,414	50,000	3.2175	3.1818	3.1797
0.	.....	.....	.....	3.2137	3.1797	3.1783

Two cracks were developed in the cast-iron grenade at the joint next the case.
There was general bulging of the shrapnel, as indicated by measurements on diameters B and C, and a well-defined ridge thrown out at the circumferential groove at diameter A.

HELICAL SPRINGS

FOR

7-INCH MORTAR CARRIAGES.

COMPRESSION TESTS OF HELICAL SPRINGS.

Dimensions of springs...

	Inches.
Diameter of wire	.50
Exterior diameter of coils	3.84
Distance between adjacent coils of same spring	.67

Weight of one spring, 4 pounds 10 ounces.

No. of test.	Initial height of spring.	Loads when heights of springs were—					Final height of spring.
		6″.	4⅝″.	Closed down.		6″.	
				Load.	Height.		
	Inches.	*Pounds.*	*Pounds.*	*Pounds.*	*Inches.*	*Pounds.*	*Inches.*
7007	7.90	751	1,228	1,700	4.07	703	7.89
7008	7.98	796	1,266	1,620	4.07	747	7.93
7009	7.96	760	1,215	1,598	4.09	717	7.90
7010	7.91	722	1,172	1,540	4.10	676	7.87
7011	7.80	726	1,190	1,520	4.20	660	7.74
7012	7.90	741	1,178	1,600	4.10	664	7.81
7013	7.97	771	1,222	1,620	4.02	698	7.89
7014	7.90	732	1,186	1,550	4.10	698	7.87
7015	7.92	716	1,162	1,560	4.08	666	7.90
7016	7.90	741	1,188	1,530	4.08	673	7.82

Springs Nos. 7008 and 7011 closed down and kept in that condition 17 hours, then released and retested.

No. of test.	Initial height of spring.	Loads when heights of springs were—					Final height of spring.
		6″.	4⅝″.	Closed down.		6″.	
				Load.	Height.		
	Inches.	*Pounds.*	*Pounds.*	*Pounds.*	*Inches.*	*Pounds.*	*Inches.*
7008 *a*	7.73	678	1,140	1,490	4.07	652	7.69
7011 *a*	7.59	610	1,078	1,420	4.20	566	7.57
7016 *a*	7.83	712	.....	.....	.....	.....	.....

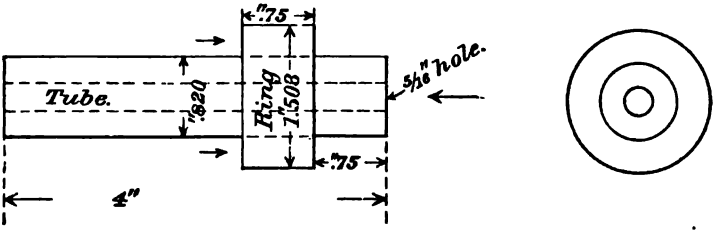
Spring No. 7016 was loaded five times, compressing the spring each time to a height of 4″.25; finally the spring at a height of 6″ sustains 665 pounds, the final height unloaded being 7″.80.

RESISTANCE OF RING

AND

NUT ON WROUGHT-IRON TUBE.

FRICTIONAL RESISTANCE OF A STEEL RING SHRUNK ON A WROUGHT-IRON TUBE.



No. 6211.

Interior diameter of ring bored to ".815; it was then expanded by heat, and shrunk on the tube.

Ring was forced off the nearer end of the tube.

Ultimate frictional resistance, 23,700 pounds.

A sudden throb accompanied the first starting of the ring along the tube, the load being momentarily reduced.

Again increasing the pressure on the ring, the maximum resistance was again met, after which there was a gradual loss in frictional resistance as the movement of the ring was continued.

The metal of the tube in front of the ring was abraded and small chips sheared off the surface.

That part of the tube which was covered by the ring when in position ready for testing was not sensibly abraded, nor was the inside turface of the ring.

s

RESISTANCE OF STEEL NUT SCREWED ON A WROUGHT-IRON TUBE.

No. 6212.

A steel nut $\frac{3}{4}$" long by 1".5 outside diameter was screwed on the opposite end of the wrought-iron tube used in test No. 6211, using a Franklin Institute thread 14 per inch.

Diameter at the root of the thread on the tube was ".75.

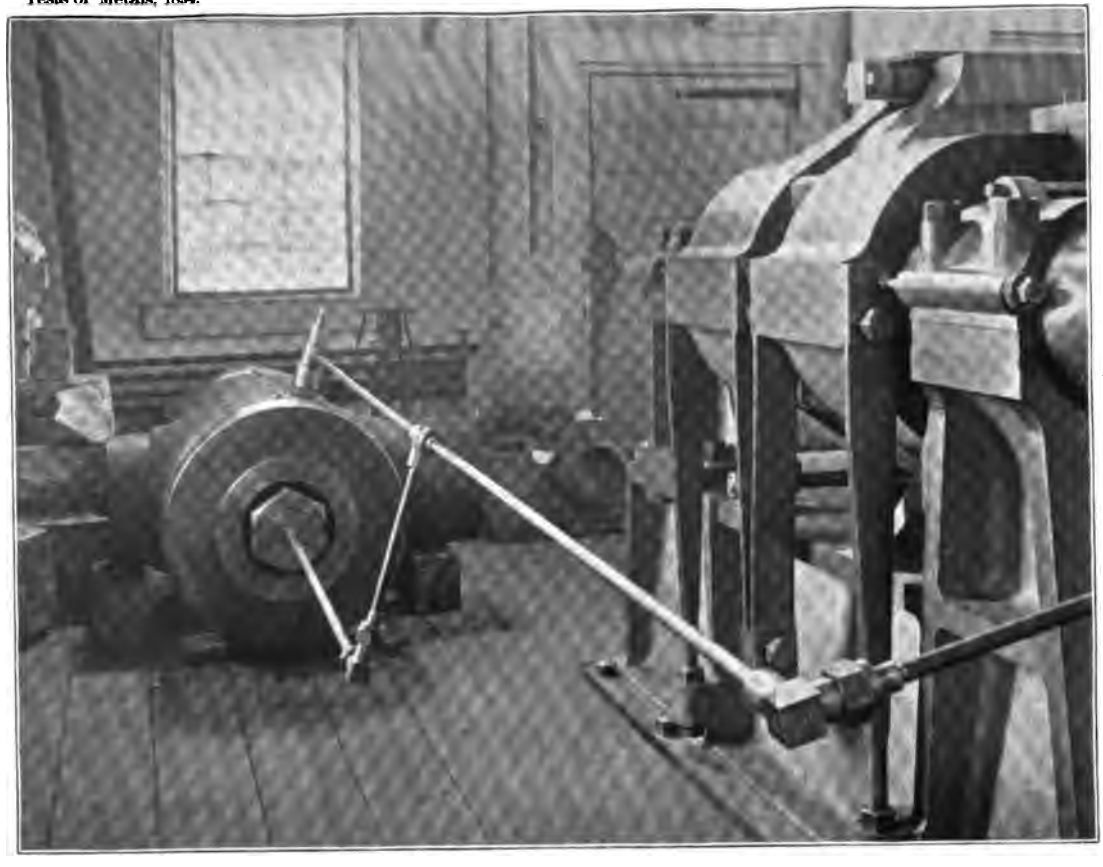
The nut was loaded with 35,000 pounds in the direction required to strip the thread.

The end of the tube, which had been turned down to ".75 diameter, was upset by this pressure, but the thread was not apparently injured; the nut could be unscrewed.

HYDROSTATIC TEST

OF

8-INCH TUBE SECTION.



HYDROSTATIC TEST, 8" TUBE SECTION.

Photograph of attachments used in test with interior and exterior pressures combined.

HYDROSTATIC TEST OF 8-INCH TUBE SECTION.

TESTS CONTINUED FROM REPORT 1893.

The investigation of the elastic properties of this section of an 8-inch tube included the application of hydrostatic pressures as follows:

1. Interior pressure.
2. Exterior pressure.
3. Interior and exterior pressures combined.
4. Interior pressure and longitudinal tension combined.
5. Exterior pressure and longitudinal tension combined.
6. Interior and exterior pressures and longitudinal tension combined.
7. Interior pressure and longitudinal compression combined.
8. Exterior pressure and longitudinal compression combined.
9. Interior and exterior pressures and longitudinal compression combined.

To these tests was added an examination of the tube under the effects of direct longitudinal compressive stresses applied to the ends of the tube.

Supplementary tests remain to be completed for the purpose of determining the diametrical and longitudinal changes at different parts of the thickness of the walls of the tube, and to apply longitudinal tensile stress by direct attachment to the testing machine, not employing hydrostatic pressure for the purpose.

It is then intended to apply hydrostatic pressures which will overstrain the tube and cause permanent sets to be acquired in different ways, finally making an examination of the metal of the tube by means of tension and compression specimens and initial tension rings.

In each of the completed tests the longitudinal strains were measured, and changes in the diameter of the bore or exterior diameter ascertained when those surfaces were accessible.

In the Report of Tests, 1893, are recorded the results by direct longitudinal compressive stresses and those under interior hydrostatic pressure.

The interior hydrostatic pressure was applied by charging the bore of the tube with water, and inserting at the ends pistons carrying leather packings, loads being applied with the testing machine directly against the projecting ends of the pistons.

In the tests herewith reported, the hydrostatic pressure was transmitted to the tube by means of strong pipes from a reservoir located in the testing machine.

The reservoir was a cast-iron cylinder 18″ exterior diameter by 36″ long, having a bore 3″.75 diameter, reduced to 3″.37 diameter by a brass lining; thus giving a piston area of 8.92 square inches.

While under test with exterior pressures the tube occupied a position within the steel jacket shown on plate 1. In tests with interior pressure unaccompanied by exterior pressure, the naked tube was used and was accessible for exterior surface measurements.

Describing the fixtures employed, and method of taking the measurements in each test, plate 2 shows the tube and pistons as used in the test with interior pressure.

The length of bore exposed to pressure was about 36″. This length necessarily varied with the pressure on account of the enlargement of the bore and the compressibility of the water.

Diametrical expansion was measured by means of a caliper arm carrying a micrometer point at one end and a fixed point at the other. The caliper arm was suspended by a long helical spring, allowing easy and convenient manipulation without sensible distortion of the arm due to handling it.

The longitudinal contraction was measured by means of a micrometer mounted along the upper element of the tube.

This micrometer remained in position while a given series of longitudinal measurements were made.

Plate 3 is a sectional view of one end of the tube in the jacket while in position for the test with exterior pressure.

The water pressure has access to a length of 40″ on the exterior surface of the tube.

The space filled by the water was $\frac{1}{10}$ of an inch wide, excepting near the ends, where the jacket was bored out to a larger diameter to admit of packing glands and threaded to receive nuts for holding the packings of subsequent tests.

A nut screwed into the end of the jacket held in place a gland and its cup-shaped leather packing.

The water was admitted to the annular water space through a drilled supply hole in the jacket, not shown in this plate.

Pipes from the reservoir led to the supply hole in the jacket, the upper end of the hole being bored and threaded to receive a valve.

Measurements of the bore were made with the micrometer shown on the accompanying photograph.

The end of the instrument opposite the micrometer terminated in a conical point, which point entered punch marks lightly made in the surface of the bore of the tube, to insure the measurements being taken in the same places throughout each series of observations.

While in use the instrument was protected against rapid change in temperature by a felt covering.

The longitudinal extension was measured on two gauged lengths of 20 inches each, 180 degrees apart, symmetrical with the length of the tube, and at the middle of the thickness of its walls.

For this purpose holes $\frac{1}{4}$ inch diameter were drilled in the ends of the tube a depth of 12 inches each, and had flat bottoms.

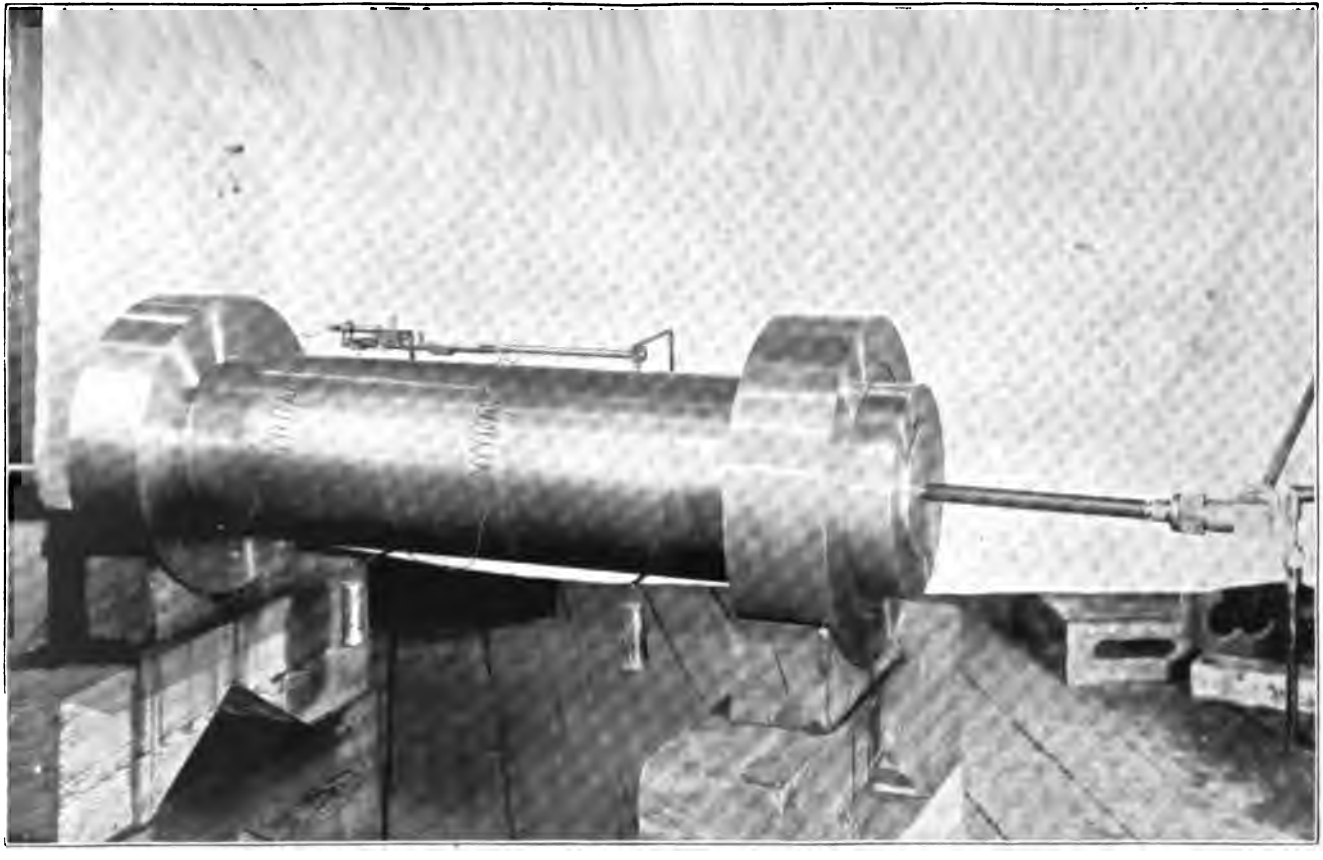
Rods nearly filling these holes bottomed in the tube and projected beyond the end faces of the jacket sufficiently to be measured over their ends.

On plate 4 is shown the tube as arranged to receive interior and exterior pressures simultaneously.

In addition to the attachments described with plate 3, a 6-inch bar is used in the bore of the tube, with nuts, glands, and leather packings, for the interior pressure.

A branch pipe leads from a tee in the main pipe, between the reservoir and the jacket, to the hole drilled in the 6-inch bar, and supplies the water for the interior pressure.

In this test only the measuring rods for longitudinal extension of the tube are accessible, the measurements of diameters necessarily being omitted.



HYDROSTATIC TEST, 8" TUBE SECTION.

Photograph of attachments used in test with interior pressure and longitudinal compression combined.

The accompanying photograph shows the attachments in use for this test. In the illustration may be seen the method of piping, the valve on the top of the jacket, and the end of the 6-inch bar central with the end of the jacket.

The ¼-inch rods used in measuring the longitudinal extension of the tube occupied a position immediately at the sides of the nut on the 6-inch bar, where two square-cornered recesses are seen to have been chipped away.

Plate 5 shows the tube arranged for test with interior pressure and longitudinal tension combined.

The water pressure is transmitted, as before described, from the reservoir in the testing machine through strong pipes to the interior of the tube, making connection with the gland at the tapped hole in the latter.

The end thrust or longitudinal tension exerted by the gland is resisted by the cap nut screwed over the end of the tube.

The end of the tube at this stage was turned down and threaded for the cap nut, and also with a larger threaded section for subsequent tests, with a plain section between the two threaded parts which was made 11″.313 diameter to obtain the area 50.26 square inches between that diameter and the enlarged bore of the jacket, 13″.856.

The hydrostatic pressure, it will be seen, acts on the full area of the bore, 50.26 square inches.

This area is used in the subsequent tests when longitudinal stresses, either of tension or compression, are employed.

The diametrical expansion and longitudinal extension of the tube were measured in this test, the former by means of a caliper arm carrying measuring and fixed points, the latter by a micrometer mounted on the upper element of the tube.

Plate 6 illustrates the arrangement for the test with exterior pressure and longitudinal tension combined.

The face of the nut which is screwed on the tube presents an area of 50.26 square inches, which is the same as the area of the bore.

The positions of the rods used while measuring longitudinal extension are indicated on this drawing.

Longitudinal extensions and the contraction of the bore were measured, both in the manner before described.

Plate 7 shows the arrangement for the test with interior and exterior pressures and longitudinal tension combined.

This arrangement of parts closely resembles that illustrated on plate 4.

In the present instance, however, the exterior gland is replaced by the nut screwed on the end of the tube, the large nut in the jacket being omitted.

Measurements of longitudinal extension only were taken during this test.

Plate 8 shows the tube arranged for the test with interior pressure and longitudinal compression combined.

This test was made at an earlier stage in the investigation than here reported. It actually followed the test with interior and exterior pressures combined. For economy in the number of accessory fixtures required, a certain order of testing became necessary.

In this test a 7″.9 bar was used in the bore of the tube, which carried a nut at each end, retaining in position a sleeve and its nut.

The ends of the tube covered by the sleeves were turned down to 11″.313 diameter, and therefore presented end areas of 50.26 square inches each, against which areas the water pressure acted, giving the desired longitudinal stress.

Measurements of diametrical extension and longitudinal contraction were taken.

A photograph shows the tube with micrometer attached for longitudinal measurements.

On plate 9 is shown the arrangement of parts for the test with exterior pressure and longitudinal compression combined.

The exterior pressure has access along the middle of the length of the tube 29″.4.

The length under pressure is limited by the packings for back pressure, which enables the tube to receive longitudinal stress from the pressure on the face of the nut, which is screwed to it.

The water space between this nut and the gland has communication with the water space along the middle part of the tube through a by-pass.

These outer water spaces increase the length of tube under pressure to a total of 32″.8.

The vent hole allowed the escape of any water which leaked by the packings, preventing any accumulation of back pressure.

It may be remarked in regard to the behavior of the packings that they sealed the water pressures in a very satisfactory manner. They were initially set out by temporary connection with a hand force-pump of comparatively large capacity, and, after a pressure of 150 pounds per square inch had been applied in this manner, the packings thereafter under higher pressures showed very little leakage.

The hydrostatic pressure was so well maintained under each load that ample time was afforded for taking the micrometer readings before sensible change in pressure occurred.

In the present test, measurements of the contraction of bore and longitudinal extension were obtained.

The rods for longitudinal strains, although not indicated in the drawing, occupied the same position as before described.

Plate 10 illustrates the arrangement of parts for the test with interior and exterior pressures and longitudinal compression combined.

The arrangement is the same as in the test last described, with the addition of the 6-inch bar with glands and packings for the interior pressure.

Longitudinal measurements only were made, showing the contraction in length of the tube under this combination of pressures.

In carrying out the details of the tests a number of measurements were taken on each diameter and longitudinal gauged length under the several pressures employed, in order to obtain mean values of the strains developed.

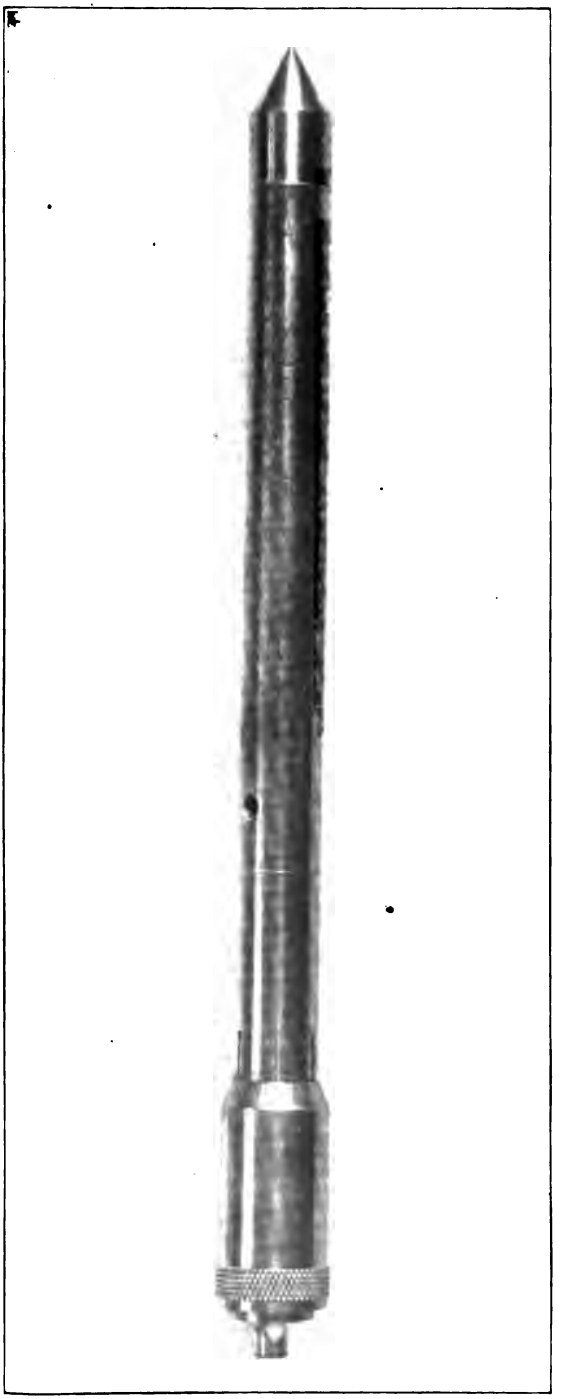
This was for the purpose of eliminating the effects of change in temperature of the measuring instruments, so far as practicable.

The larger mass of the tube and its accessories prevented any rapid changes in their dimensions due to temperature effects.

What appear to be permanent sets in certain of the series are thought to be, in most instances, temperature changes affecting the micrometers.

In the test with exterior pressure the contraction of the bore was measured in two planes at right angles to each other, and at each end of the 20-inch gauged length on which the longitudinal expansion was determined. These diameters were measured at an angle of 45°, with a horizontal plane.

The results showed so close an agreement in the amount of contraction on the different diameters that it was regarded as sufficient in the



HYDROSTATIC TEST, 8″ TUBE SECTION. MICROMETER FOR INTERIOR DIAMETERS.

subsequent tests to measure the bore in two places only, one at each end of the 20-inch section, and choosing a vertical plane as the most convenient.

The longitudinal effects were measured on the top element of the exterior surface when that surface was accessible; in other cases the measurements were taken by means of the $\frac{1}{4}$-inch rods, inserted and bottoming in drilled holes 12 inches deep at the middle of the thickness of the walls of the tube.

These rods were about ".003 smaller in diameter than the drilled holes.

The maximum pressures applied were kept within such limits that the elastic limit of the metal was not exceeded.

Tensile specimens taken from the original forging of the tube, somewhat remote from this section under test, showed that limit to be not far from 37,000 pounds per square inch.

The mean results are tabulated, averaging diametrical effects at each end of the 20-inch gauged length, and averaging also the longitudinal effects in those instances where two 20-inch lengths were measured.

When conjoint diameters or longitudinals showed the same amount of strain, or if the differences did not exceed ".0002, no account of the fact is taken in the tabulation of mean results, but when the differences exceed ".0002 a statement is made of each diameter or longitudinal, and also the averages of both are given.

In the report of tests, 1893, it was stated that the ratio of longitudinal contraction to diametrical expansion for interior pressures was found to be $\frac{1}{3.64}$.

The tests herewith reported under exterior pressures yield the value $\frac{1}{3.60}$, results nearly identical.

The reductions made from the summarized results state the diametrical and longitudinal changes per inch per pound applied pressures.

TEST WITH EXTERIOR PRESSURE.

CONTRACTION OF BORE.

Measurements taken on two diameters 180° apart each at extremities of 20-inch section, symmetrical with ends of tube.

South end.

Pressure per square inch.	Measurements of bore.				Remarks.
	Diameter S_1.	Successive differences.	Diameter S_2.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
4,000	7.9971	.....	7.9972	.....	
1,000	8.0000	.0029	8.0000	.0028	
4,000	7.9972	.0028	7.9971	.0029	
6,000	7.9952	.....	7.9953	.....	
1,000	8.0000	.0048	8.0000	.0047	
6,000	7.9952	.0048	7.9953	.0047	
1,000	7.9999	.0047	8.0000	.0047	
1,000	8.0000	.....	8.0000	.....	
8,000	7.9932	.0068	7.9935	.0065	
1,000	8.0000	.0068	8.0000	.0065	
8,000	7.9932	.0068	7.9935	.0065	
1,000	8.0000	.0068	8.0001	.0066	
1,000	8.0000	.....	8.0000	.....	
10,000	7.9914	.0086	7.9914	.0086	
1,000	7.9999	.0085	8.0000	.0086	
10,000	7.9913	.0086	7.9915	.0085	
1,000	8.0000	.0087	8.0000	.0085	
10,000	7.9913	.0087	7.9916	.0084	
1,000	7.9999	.0086	8.0000	.0084	

North end.

Pressure per square inch.	Measurements of bore.				Remarks.
	Diameter N_1.	Successive differences.	Diameter N_2.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
4,000	7.9970	.....	7.9972	.....	
1,000	8.0000	.0030	8.0000	.0028	
4,000	7.9972	.0028	7.9973	.0027	
6,000	7.9954	.....	7.9953	.....	
1,000	8.0000	.0046	8.0000	.0047	
6,000	7.9954	.0046	7.9953	.0047	
1,000	8.0001	.0047	8.0000	.0047	
1,000	8.0000	.....	.....	.....	
8,000	7.9934	.0066	7.9933	.....	
1,000	8.0000	.0066	8.0000	.0067	
8,009	7.9934	.0066	7.9934	.0066	
1,000	.....	.....	8.0000	.0066	
10,000	.....	.....	7.9913	.....	
1,000	8.0000	.....	8.0000	.0087	
10,000	7.9915	.0085	7.9914	.0086	
1,000	8.0000	.0085	7.9999	.0085	
10,000	7.9915	.0085	7.9914	.0085	
1,000	8.0000	.0085	7.9999	.0085	

TEST WITH EXTERIOR PRESSURE.

LONGITUDINAL EXTENSION.

Measurements taken at middle of thickness of walls on two 20-inch sections 180° apart, symmetrical with ends of tube.

Pressure per square inch	Measurements of 20-inch longitudinal.				Remarks.
	W.	Successive differences.	E.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
4,000	20.0020	.....	20.0020	.....	
1,000	20.0000	.0020	20.0000	.0020	
4,000	20.0021	.0021	20.0019	.0019	
1,000	20.0000	.0021	.....	.....	
4,000	20.0021	.0021	20.0018	.....	
1,000	.....	.....	20.0000	.0018	
4,000	.....	.....	20.0021	.0021	
1,000	.....	.....	20.0001	.0020	
4,000	.....	.....	20.0021	.0020	
1,000	.....	.....	20.0001	.0020	
4,000	.....	.....	20.0021	.0020	
1,000	.....	.....	20.0001	.0020	
1,000	20.0000	.....	.....	.....	
6,000	20.0032	.0032	20.0034	.....	
1,000	19.9998	.0034	20.0000	.0034	
6,000	20.0032	.0034	20.0035	.0035	
1,000	19.9998	.0034	20.0000	.0035	
6,000	20.0032	.0034	20.0035	.0035	
1,000	19.9998	.0034	20.0000	.0035	
8,000	20.0045	.....	.....	.....	
1,000	20.0000	.0045	20.0000	.....	
8,000	20.0049	.0049	20.0045	.0045	
1,000	20.0002	.0047	19.9998	.0047	
8,000	20.0050	.0048	20.0045	.0047	
1,000	20.0003	.0047	19.9998	.0047	
8,000	20.0050	.0047	20.0045	.0047	
1,000	20.0003	.0047	19.9998	.0047	
8,000	20.0050	.0047	.....	.....	
1,000	20.0004	.0046	.....	.....	
8,000	20.0050	.0046	.....	.....	
1,000	20.0003	.0047	.....	.....	
1,000	20.0000	.....	20.0000	.....	
10,000	20.0060	.0060	20.0057	.0057	
1,000	20.0000	.0060	19.9997	.0060	
10,000	20.0060	.0060	20.0057	.0060	
1,000	19.9999	.0061	19.9997	.0060	
10,000	20.0060	.0061	20.0058	.0061	
1,000	19.9999	.0061	19.9997	.0061	
10,000	20.0059	.0060	20.0057	0060	
1,000	19.9999	.0060	19.9997	0060	

TEST WITH INTERIOR AND EXTERIOR PRESSURES COMBINED.

LONGITUDINAL EXTENSION.

Measurements taken at middle of thickness of walls on two 20-inch sections 180° apart, symmetrical with ends of tube.

Pressure per square inch.	Measurements of 20-inch longitudinal.				Remarks.
	W.	Successive differences.	E.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	20.0000	.....	.....	.....	
4,000	20.0013	.0013	20.0013	.....	
1,000	20.0001	.0012	20.0000	.0013	
4,000	20.0015	.0014	20.0010	.0010	
1,000	20.0002	.0013	19.9998	.0012	
4,000	20.0015	.0013	20.0010	.0012	
1,000	20.0003	.0012	19.9999	.0011	
4,000	20.0015	.0012	20.0009	.0010	
1,000	20.0003	.0012	19.9997	.0012	
4,000	20.0015	.0012	20.0009	.0012	
1,000	.....	.....	19.9997	.0012	
6,000	20.0018	.....	.....	.....	
1,000	20.0000	.0018	.....	.....	
6,000	20.0020	.0020	.....	.....	
1,000	20.0003	.0017	.....	.....	
6,000	20.0023	.0020	.....	.....	
1,000	20.0004	.0019	.....	.....	
6,000	20.0023	.0019	.....	.....	
1,000	20.0003	.0020	.....	.....	
6,000	20.0023	.0020	.....	.....	
1,000	20.0003	.0020	.....	.....	
8,000	20.0026	.....	.....	.....	
1,000	20.0000	.0026	.....	.....	
8,000	20.0026	.0026	.....	.....	
1,000	20.0000	.0026	.....	.....	
8,000	20.0026	.0026	.....	.....	
1,000	19.9999	.0027	.....	.....	
8,000	20.0026	.0027	.....	.....	
1,000	19.9999	.0027	.....	.....	
8,000	20.0026	.0027	.....	.....	
1,000	20.0000	.0026	.....	.....	
10,000	20.0034	.....	20.0033	.....	
1,000	20.0000	.0034	20.0000	.0033	
10,000	20.0035	.0035	20.0036	.0036	
1,000	20.0000	.0035	20.0002	.0034	
10,000	20.0035	.0035	20.0036	.0034	
1,000	19.9999	.0036	20.0002	.0034	
10,000	20.0035	.0036	20.0036	.0034	
1,000	19.9999	.0036	20.0002	.0034	
10,000	20.0035	.0036	20.0036	.0034	
1,000	20.0001	.0034	20.0002	.0034	
10,000	.....	.....	20.0036	.0034	
1,000	.....	.....	20.0002	.0034	

TEST WITH INTERIOR PRESSURE AND LONGITUDINAL TENSION COMBINED.

DIAMETRICAL EXPANSION.

Measurements taken on two diameters 180° apart at middle of length of tube.

Pressure per square inch.	Measurements of exterior diameters.				Remarks.
	Diameter 1.	Successive differences.	Diameter 2.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	12.0000	.....	.....	.....	
8,000	12.0029	.0039	.....	.....	
1,000	12.0000	.0039	.....	.....	
8,000	12.0029	.0039	.....	.....	
1,000	12.0000	.....	12.0000	.....	
11,000	12.0054	.0054	12.0055	.0055	
1,000	12.0000	.0054	12.0000	.0055	
11,000	12.0054	.0054	12.0055	.0055	
1,000	11.9999	.0055	12.0000	.0055	
11,000	12.0054	.0055	12.0055	.0055	
1,000	11.9999	.0055	12.0000	.0055	
11,000	12.0054	.0055	12.0055	.0055	
1,000	11.9999	.0055	12.0000	.0055	

TEST WITH INTERIOR PRESSURE AND LONGITUDINAL TENSION COMBINED.

LONGITUDINAL EXTENSION.

Measurements taken on 20-inch section on outside surface symmetrical with ends of tube.

Pressure per square inch.	Measurements of 20-inch longitudinal.		Remarks.
	Total	Successive differences.	
Pounds.	*Inches.*	*Inch.*	
1,000	20.0000	.....	
2,000	20.0002	.0002	
3,000	20.0005	.0003	
4,000	20.0007	.0002	
5,000	20.0009	.0002	
6,000	20.0011	.0002	
7,000	20.0014	.0003	
8,000	20.0016	.0002	
1,000	20.0000	.0016	
1,000	20.0000	.....	
5,000	20.0010	.0010	
8,000	20.0016	.0006	
11,000	20.0023	.0007	
8,000	20.0016	.0007	
5,000	20.0010	.0006	
1,000	20.0000	.....	
11,000	20.0023	.0023	
1,000	20.0001	.0022	
11,000	20.0023	.0022	
1,000	20.0001	.0022	
11,000	20.0024	.0023	
1,000	20.0002	.0022	
11,000	20.0024	.0022	
1,000	20.0002	.0022	
11,000	20.0024	.0022	
1,000	20.0002	.0022	

TEST WITH EXTERIOR PRESSURE AND LONGITUDINAL TENSION COMBINED.

CONTRACTION OF BORE.

Measurements taken in the same plane at extremities of 20-inch section symmetrical with ends of tube.

Pressure per square inch.	Measurements of bore.				Remarks.
	Diameter S.	Successive differences.	Diameter N.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	8.0000	.....	.....	.....	
8,000	7.9928	.0072	.....	.....	
1,000	7.9999	.0071	.....	.....	
8,000	7.9927	.0072	.....	.....	
1,000	7.9999	.0072	.....	.....	
8,000	7.9927	.0072	.....	.....	
1,000	8.0000	.0073	.....	.....	
1,000	8.0000	.....	8.0000	.....	
9,500	7.9912	.0088	7.9912	.0088	
1,000	7.9999	.0087	8.0000	.0088	
9,500	7.9911	.0088	7.9912	.0088	
1,000	7.9998	.0087	8.0000	.0088	
9,500	7.9911	.0087	7.9913	.0087	
1,000	7.9998	.0087	8.0001	.0088	
9,500	7.9910	.0088	7.9913	.0088	
1,000	7.9998	.0088	8.0002	.0089	
9,500	7.9911	.0087	7.9913	.0089	
1,000	7.9998	.0087	8.0002	.0089	

TEST WITH EXTERIOR PRESSURE AND LONGITUDINAL TENSION COMBINED.

LONGITUDINAL EXTENSION.

Measurements taken at middle of thickness of walls on two 20-inch sections 180° apart symmetrical with ends of tube.

Pressure per square inch.	Measurements of 20-inch longitudinal.				Remarks.
	E.	Successive differences.	W.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
9,500	20.0092	.....	20.0090	.....	
1,000	20.0000	.0092	20.0000	.0090	
9,500	20.0092	.0092	20.0092	.0092	
1,000	20.0000	.0092	20.0001	.0091	
9,500	20.0092	.0092	20.0092	.0091	
1,000	20.0000	.0092	20.0002	.0090	
9,500	20.0092	.0092	20.0093	.0091	
1,000	20.0000	.0092	20.0002	.0091	
9,500	.....	.....	20.0092	.0090	
1,000	.....	.....	20.0002	.0090	
9,500	.....	.....	20.0092	.0090	
1,000	.....	.....	20.0002	.0090	

TEST WITH INTERIOR AND EXTERIOR PRESSURES AND LONGITUDINAL TENSION COMBINED.

LONGITUDINAL EXTENSION.

Measurements taken at middle of thickness of walls on two 20-inch sections 180° apart symmetrical with ends of tube.

Pressure per square inch.	Measurements of 20-inch longitudinal.				Remarks.
	W.	Successive differences.	E.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
9,500	20.0069	.....	.....	.....	
1,000	20.0000	.0069	.....	.....	
9,500	20.0068	.0068	.....	.....	
1,000	19.9999	.0069	.....	.....	
9,500	20.0067	.0068	.....	.....	
1,000	19.9999	.0068	.....	.....	
9,500	20.0066	.0067	.....	.....	
1,000	19.9998	.0068	.....	.....	
9,500	20.0066	.0068	.....	.....	
1,000	19.9999	.0067	.....	.....	
10,000	20.0071	.....	.....	.....	
1,000	20.0000	.0071	20.0000	.....	
10,000	20.0072	.0072	20.0068	.0068	
1,000	20.0001	.0071	19.9998	.0070	
10,000	20.0072	.0071	20.0068	.0070	
1,000	20.0002	.0070	19.9999	.0069	
10,000	20.0072	.0070	20.0068	.0070	
1,000	20.0003	.0071	19.9998	.0070	
10,000	20.0073	.0070	20.0068	.0070	
1,000	20.0003	.0070	19.9999	.0069	
10,000	.....	.....	20.0067	.0068	
1,000	.....	.....	19.9998	.0069	
10,000	.....	.....	20.0066	.0068	
1,000	.....	.....	19.9997	.0069	
10,000	.....	.....	20.0066	.0069	
1,000	.....	.....	19.9996	.0070	

TEST WITH INTERIOR PRESSURE AND LONGITUDINAL COMPRESSION COMBINED.

DIAMETRICAL EXPANSION.

Measurements taken on two diameters 180° apart at middle of length of tube; also 10 inches from middle.

Pressure per square inch.	Measurements of exterior diameters at middle of tube.				Remarks.
	Diameter 1.	Successive differences.	Diameter 2.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	12.0000	.....	.....	.....	
6,000	12.0034	.0034	.....	.....	
1,000	12.0000	.0034	.....	.....	
6,000	12.0034	.0034	.....	.....	
1.000	12.0000	.0034	.....	.....	
6,000	12.0034	.0034	.....	.....	
8,000	12.0050	.....	.....	.....	
1,000	12.0000	.0050	.....	.....	
8,000	12.0050	.0050	.....	.....	
1,000	12.0000	.0050	.....	.....	
11,000	12.0070	.....	.....	.....	
1,000	12.0000	.0070	12.0000	.....	
11,000	12.0071	.0071	12.0071	.0071	
1,000	12.0001	.0070	12.0000	.0071	
11,000	12.0071	.0070	12.0070	.0070	
1,000	12.0001	.0070	11.9999	.0071	
11,000	12.0071	.0070	12.0070	.0071	
1,000	12.0000	.0071	11.9999	.0071	

MEASUREMENTS OF EXTERIOR DIAMETER 10 INCHES FROM MIDDLE OF TUBE.

1,000	12.0000	.....	.....	.....	
11,000	12.0071	.0071	.....	.....	
1,000	12.0000	.0071	.....	.....	

TEST WITH INTERIOR PRESSURE AND LONGITUDINAL COMPRESSION COMBINED.

LONGITUDINAL CONTRACTION.

Measurements taken on 20-inch section on outside surface symmetrical with ends of tube.

Pressure per square inch.	Measurements of 20-inch longitudinal.		Remarks.
	Total.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	
1,000	20.0000	.....	
2,000	19.9991	.0009	
3,000	19.9982	.0009	
4,000	19.9973	.0009	
5,000	19.9964	.0009	
6,000	19.9956	.0008	
1,000	19.9997	.0041	
6,000	19.9956	.0041	
1,000	19.9997	.0041	
6,000	19.9956	.0041	
1,000	19.9997	.0041	
8,000	19.9943	.....	
1,000	20.0000	.0057	
8,000	19.9943	.0057	
1,000	20.0000	.0057	
8,000	19.9942	.0058	
1,000	20.0000	.0058	
1,000	20.0000	.....	
11,000	19.9917	.0083	
1,000	20.0001	.0084	
11,000	19.9917	.0084	
1,000	20.0001	.0084	
11,000	19.9919	.0082	
1,000	20.0002	.0083	
11,000	19.9917	.....	
1,000	20.0000	.0083	
11,000	19.9916	.....	
1,000	20.0000	.0084	

TEST WITH EXTERIOR PRESSURE AND LONGITUDINAL COMPRESSION COMBINED.

CONTRACTION OF BORE.

Measurements taken in the same plane at extremities of 20-inch section symmetrical with ends of tube.

Pressure per square inch.	Measurements of bore.				Remarks.
	Diameter S.	Successive differences.	Diameter N.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	.....	.....	8.0000	.....	
11,000	7.9907	.....	7.9908	.0092	
1,000	8.0000	.0093	8.0000	.0092	
11,000	7.9907	.0093	7.9908	.0092	
1,000	8.0000	.0093	8.0000	.0092	
11,000	7.9907	.0093	7.9909	.0091	
1,000	8.0000	.0093	8.0000	.0091	
11,000	7.9907	.0093	7.9909	.0091	
1,000	8.0000	.0093	8.0000	.0091	
11,000	7.9908	.0092	7.9909	.0091	
1,000	8.0001	.0093	8.0000	.0091	

TEST WITH EXTERIOR PRESSURE AND LONGITUDINAL COMPRESSION COMBINED.

Longitudinal Extension.

Measurements taken at middle of thickness of walls on two 20-inch sections 180° apart symmetrical with ends of tube.

Pressure per square inch.	Measurements of 20-inch longitudinal.				Remarks.
	E.	Successive differences.	W.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	20.0000	.....	.....	.....	
11,000	20.0019	.0019	20.0023	.....	
1,000	20.0000	.0019	20.0000	.0023	
11,000	20.0019	.0019	20.0024	.0024	
1,000	20.0000	.0019	20.0000	.0024	
11,000	20.0019	.0019	20.0025	.0025	
1,000	20.0000	.0019	20.0001	.0024	
11,000	20.0019	.0019	20.0026	.0025	
1,000	20.0000	.0019	20.0002	.0024	
11,000	20.0019	.0019	20.0026	.0024	
1,000	20.0000	.0019	20.0003	.0022	
1,000	.....	.....	20.0000	.....	Hammered end of tube to cause vibration.
11,000	.....	.....	20.0024	.0024	
1,000	.....	.....	19.9999	.0025	
11,000	.....	.....	20.0024	.0025	
1,000	.....	.....	19.9999	.0025	

TEST WITH INTERIOR AND EXTERIOR PRESSURES AND LONGITUDINAL COMPRESSION COMBINED.

Longitudinal Contraction.

Measurements taken at middle of thickness of walls of two 20-inch sections 180° apart symmetrical with ends of tube.

Pressure per square inch.	Measurements of 20-inch longitudinal.				Remarks.
	W.	Successive differences.	E.	Successive differences.	
Pounds.	*Inches.*	*Inch.*	*Inches.*	*Inch.*	
1,000	20.0000	.....	.....	.....	
11,000	19.9993	.0007	19.9992	.....	
1,000	19.9998	.0005	20.0000	.0008	
11,000	19.9992	.0006	19.9989	.0011	
1,000	19.9997	.0005	19.9997	.0008	
11,000	19.9991	.0006	19.9987	.0010	
1,000	19.9996	.0005	19.9997	.0010	
11,000	19.9991	.0005	19.9987	.0010	
1,000	19.9996	.0005	19.9996	.0009	
11,000	19.9989	.0007	19.9987	.0009	
1,000	19.9994	.0005	19.9997	.0010	
11,000	19.9987	.0007	19.9986	.0011	
1,000	19.9992	.0005	19.9996	.0010	
6,000	19.9995	.....	19.9996	.....	
1,000	20.0000	.0005	20.0000	.0004	
6,000	19.9995	.0005	19.9996	.0004	
1,000	19.9998	.0003	20.0000	.0004	
6,000	19.9995	.0003	19.9995	.0005	
1,000	19.9998	.0003	20.0000	.0005	
6,000	19.9996	.0002	19.9996	.0004	
1,000	19.9999	.0003	20.0000	.0004	
6,000	19.9996	.0003	19.9996	.0004	
1,000	19.9998	.0002	20.0000	.0004	
6,000	19.9995	.0003	.....	.....	
1,000	19.9998	.0003	.....	.....	

SUMMARY OF RESULTS.

MEAN DIAMETRICAL AND LONGITUDINAL EFFECTS.

Original dimensions { Diameter of bore..... 8″. Exterior diameter..... 12″. Longitudinal gauged length..... 20″.

Interior pressure.

	Pressures per square inch.	Mean expansion.
Expansion of exterior diameter under pressures of.	*Pounds.* 1,000 12,000	*Inch.* Initial load. .0069

	Pressures per square inch.	Mean contraction.
Longitudinal contraction under pressures of.....	*Pounds.* 1,000 12,000	*Inch.* Initial load. .0039*

*This contraction measured on a gauged length of 24″.

Exterior pressure.

	Pressures per square inch.	Mean contraction.
Contraction of bore under pressures of.....	*Pounds.* 1,000 4,000 6,000 8,000 10,000	*Inch.* Initial load. .00284 .00467 .00665 .00854

	Pressures per square inch.	Mean extension.
Longitudinal extension under pressures of.....	*Pounds.* 1,000 4,000 6,000 8,000 10,000	*Inch.* Initial load. .00200 .00341 .00470 .00600

Interior and exterior pressures combined.

	Pressures per square inch.	Mean extension.
Longitudinal extension under pressures of.....	*Pounds.* 1,000 4,000 6,000 8,000 10,000	*Inch.* Initial load. .00124 .00188 .00261 .00344

Interior pressure and longitudinal tension combined.

	Pressures per square inch.	Mean expansion.
Expansion of exterior diameter under pressures of.	*Pounds.*	*Inch.*
	1,000	Initial load.
	8,000	.00390
	11,000	.00548

	Pressures per square inch.	Mean extension.
Longitudinal extension under pressures of.....	*Pounds.*	*Inch.*
	1,000	Initial load.
	2,000	.0002
	3,000	.0005
	4,000	.0007
	5,000	.0009
	6,000	.0011
	7,000	.0014
	8,000	.0016
	11,000	.00223

Exterior pressure and longitudinal tension combined.

	Pressures per square inch.	Mean contraction.
Contraction of bore under pressures of	*Pounds.*	*Inch.*
	1,000	Initial load.
	8,000	.00722
	9,500	.00879

	Pressures per square inch.	Mean extension.
Longitudinal extension under pressures of.....	*Pounds.*	*Inch.*
	1,000	Initial load.
	9,500	.00911

Interior and exterior pressures and longitudinal tension combined.

	Pressures per square inch.	Mean extension.
Longitudinal extension under pressures of.....	*Pounds.*	*Inch.*
	1,000	Initial load.
	9,500	.00682
	10,000	.00697

Interior pressure and longitudinal compression combined.

	Pressures per square inch.	Mean expansion.
Diametrical expansion under pressures of.....	*Pounds.*	*Inch.*
	1,000	Initial load.
	6,000	.00340
	8,000	.00500
	11,000	.00707

	Pressures per square inch.	Mean contraction.
Longitudinal contraction under pressures of.....	*Pounds.*	*Inch.*
	1,000	Initial load.
	6,000	.00410
	8,000	.00573
	11,000	.00835

Exterior pressure and longitudinal compression combined.

	Pressures per square inch.	Mean contraction.
Contraction of bore under pressures of.....	*Pounds.*	*Inch.*
	1,000	Initial load.
	11,000	.00922

	Pressures per square inch.	Contraction E.	Contraction W.	Mean contraction.
Longitudinal extension under pressures of.....	*Pounds.*	*Inch.*	*Inch.*	*Inch.*
	1,000		Initial load.	
	11,000	.00190	.00236	.00213

Interior and exterior pressures and longitudinal compression combined.

	Pressures per square inch.	Contraction W.	Contraction E.	Mean contraction.
Longitudinal contraction under pressures of.....	*Pounds.*	*Inch.*	*Inch.*	*Inch.*
	1,000		Initial load.	
	6,000	.....	.....	.00037
	11,000	.00056	.00092	.00074

From the "summary of results" the following reductions are made:

Interior pressure.

Diametrical expansion, exterior..... ".0069 ÷ (12 × 11,000) = ".000,000,052,273 per inch per pound
Longitudinal contraction..... ".0039 ÷ (24 × 11,000) = ".000,000,014,773 per inch per pound

Exterior pressure.

Diametrical contraction of bore..... ".008545 ÷ (8 × 9,000) = ".000,000,118,611 per inch per pound
Longitudinal extension ..... ".00602 ÷ (20 × 9,000) = ".000,000,033,333 per inch per pound

Interior and exterior pressures combined.

Longitudinal extension ..... ".00344 ÷ (20 × 9,000) = ".000,000,019,111 per inch per pound

Interior pressure and longitudinal tension combined.

Diametrical expansion, exterior..... ".00548 ÷ (12 × 10,000) = ".000,000,045,667 per inch per pound
Longitudinal extension..... ".00223 ÷ (20 × 10,000) = ".000,000,011,150 per inch per pound

Exterior pressure and longitudinal tension combined.

Diametrical contraction of bore..... ".00879 ÷ (8 × 8,500) = ".000,000,129,265 per inch per pound
Longitudinal extension..... ".00911 ÷ (20 × 8,500) = ".000,000,053,588 per inch per pound

Interior and exterior pressures and longitudinal tension combined.

Longitudinal extension..... ".00697 ÷ (20 × 9,000) = ".000,000,038,722 per inch per pound

Interior pressure and longitudinal compression combined.

Diametrical expansion, exterior..... ".00705 ÷ (12 × 10,000) = ".000,000,058,917 per inch per pound
Longitudinal contraction..... ".00832 ÷ (20 × 10,000) = ".000,000,041,750 per inch per pound

Exterior pressure and longitudinal compression combined.

Diametrical contraction of bore..... ".00922 ÷ (8 × 10,000) = ".000,000,115,250 per inch per pound
Longitudinal extension.....(".00190 + ".00236 ÷ 2) = ".00213.
".00213 ÷ (20 × 10,000) = ".000,000,010,650 per inch per pound

Interior and exterior pressures and longitudinal compression combined.

Longitudinal contraction..... ".00092 + ".00056 ÷ 2) = ".00074.
".00074 ÷ (20 × 10,000) = ".000,000,003,700 per inch per pound

Plate 1.

Hydrostatic test of 8-inch Tube section.

Steel jacket for retaining Tube section while under tests with Exterior pressures.

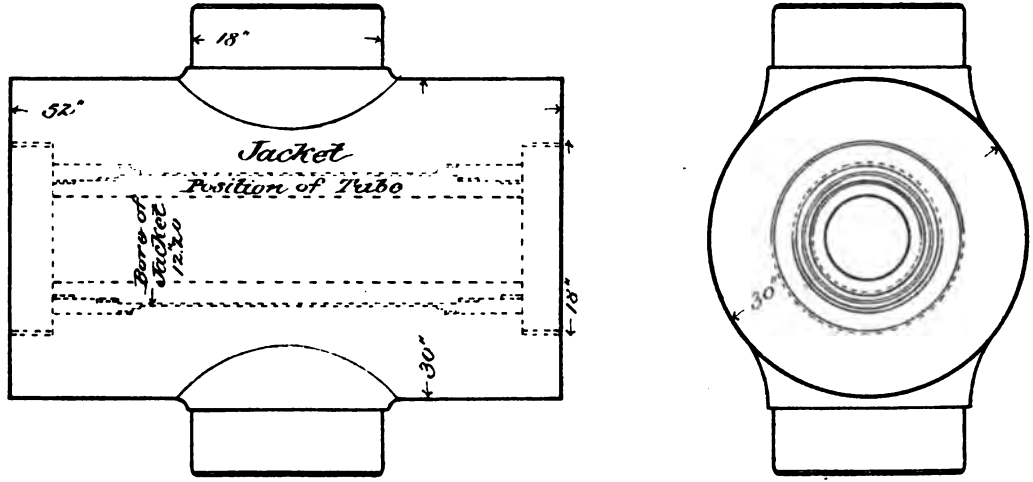


Plate 2.

Hydrostatic test of 8" tube section.

Test with interior pressure.

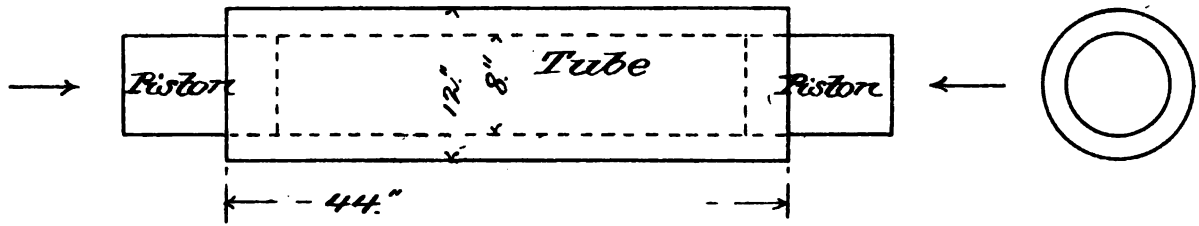
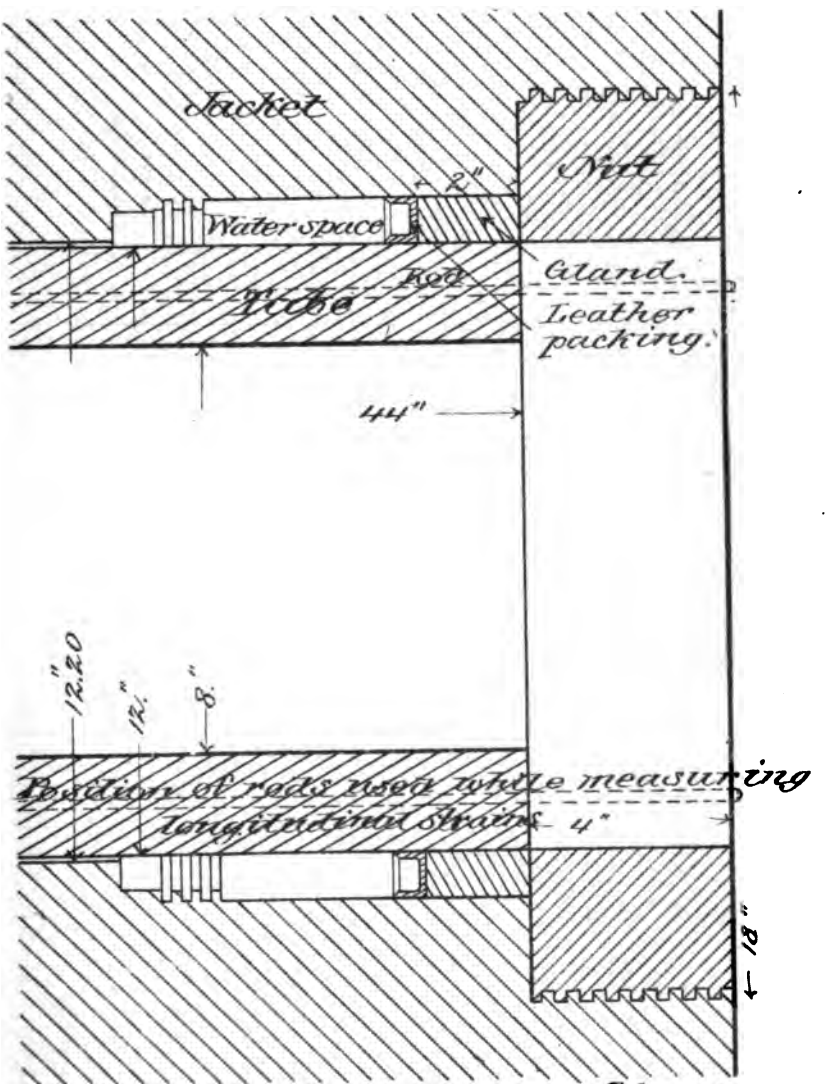


Plate 3.

Hydrostatic test, 8" tube section.

Test with exterior pressure.

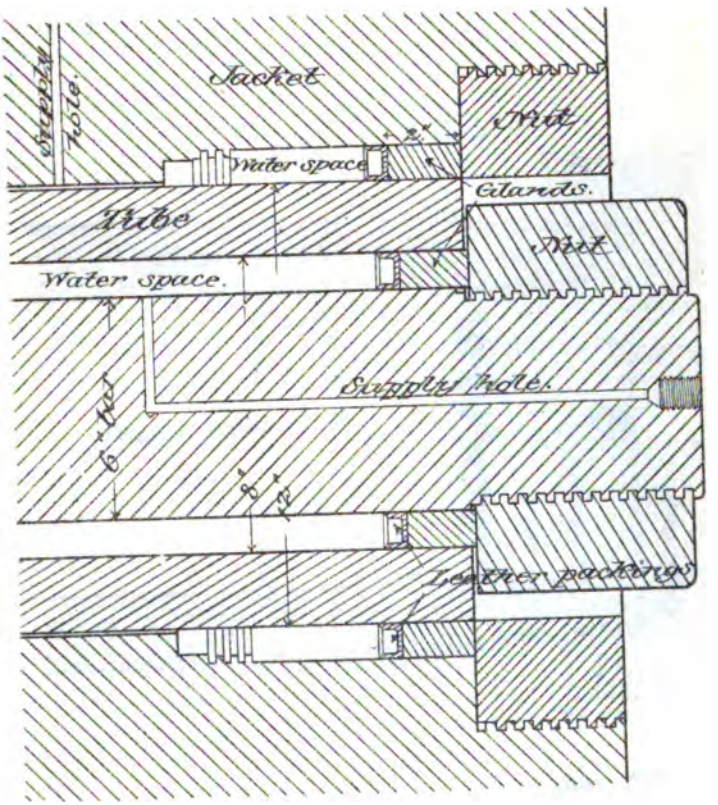


H Ex 92 53 3

Plate 4.

Hydrostatic test, 8" tube section.

Test with interior and exterior pressures combined.

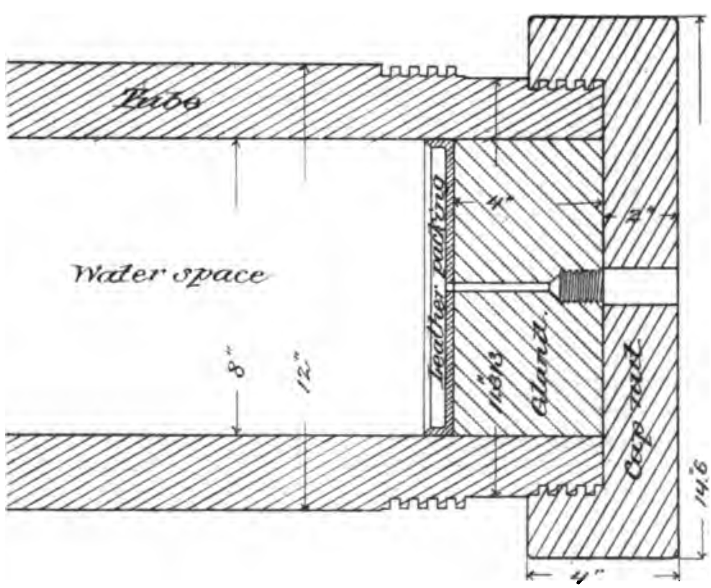


H Ex 92 53 3

Plate 5.

Hydrostatic test, 8" tube section.

Test with interior pressure and longitudinal tension combined.

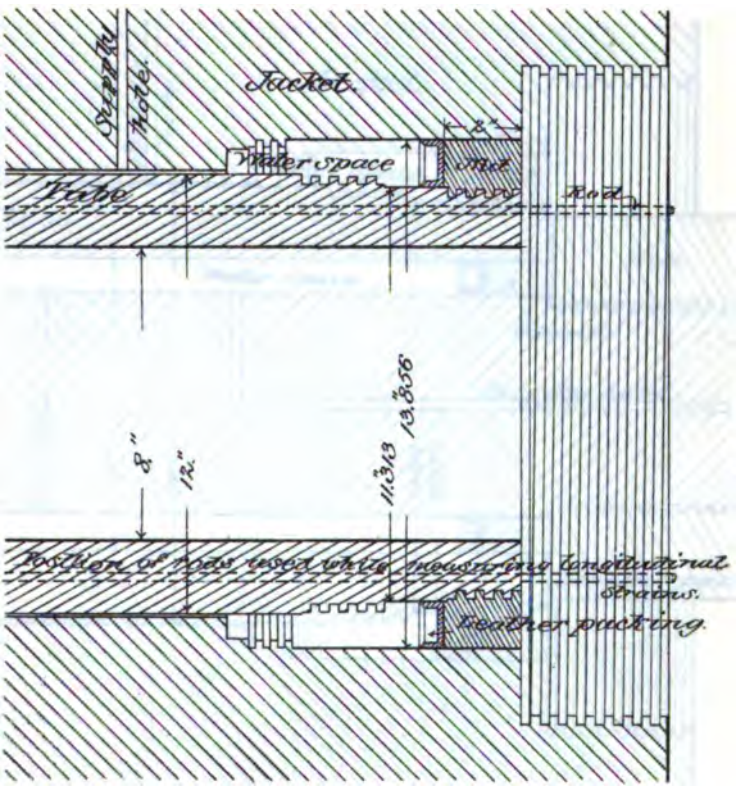


H Ex 92 58 3

Plate 6.

Hydrostatic test, 8" tube section.

Test with exterior pressure and longitudinal tension combined.



H Ex. 92 58 3

Plate 7.

Hydrostatic test, 8" tube section.

Test with interior and exterior pressures and longitudinal tension combined.

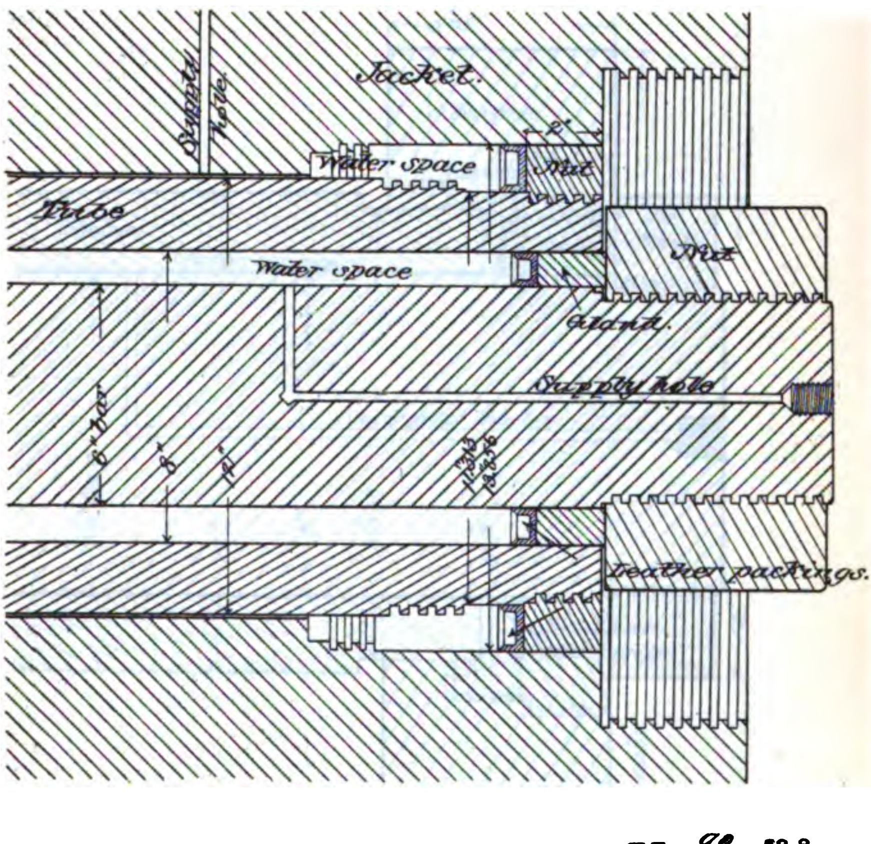
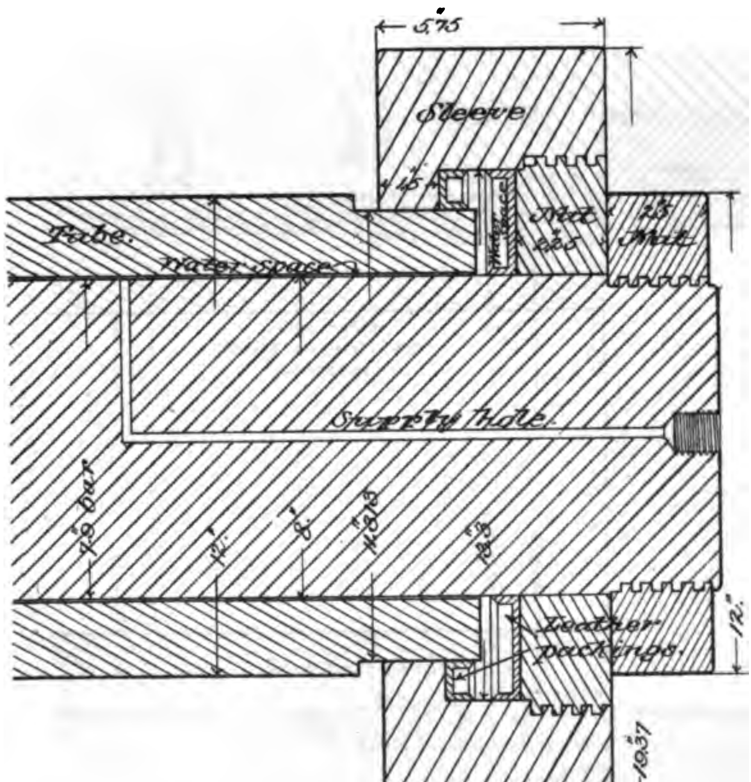


Plate 8.

Hydrostatic test, 8" tube section.

Test with interior pressure and longitudinal compression combined.



H Ex 92 53 3

Plate 9.

Hydrostatic test, 8" tube section.

Test with exterior pressure and longitudinal compression combined.

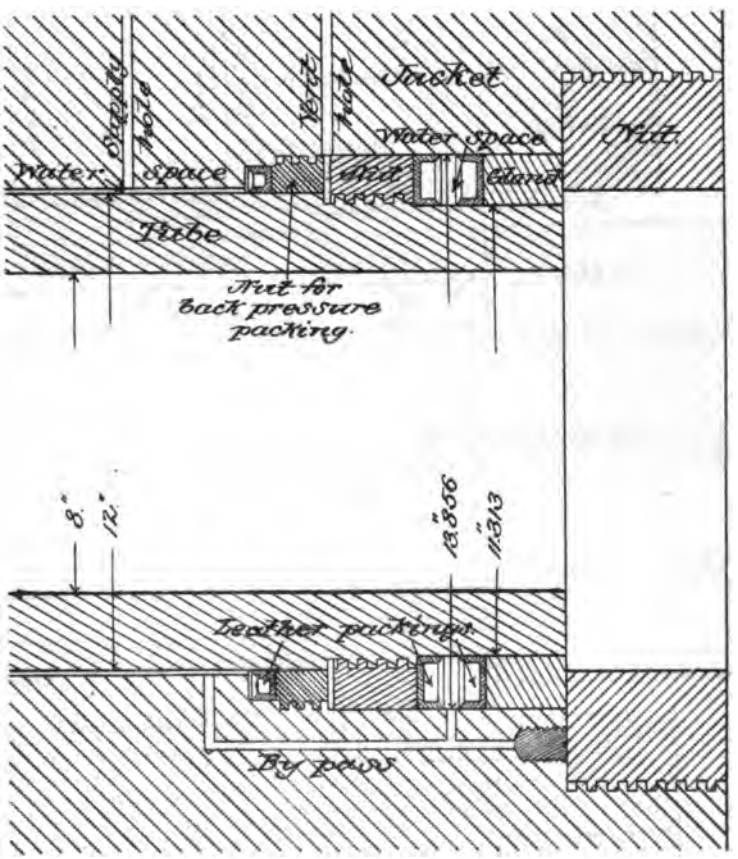
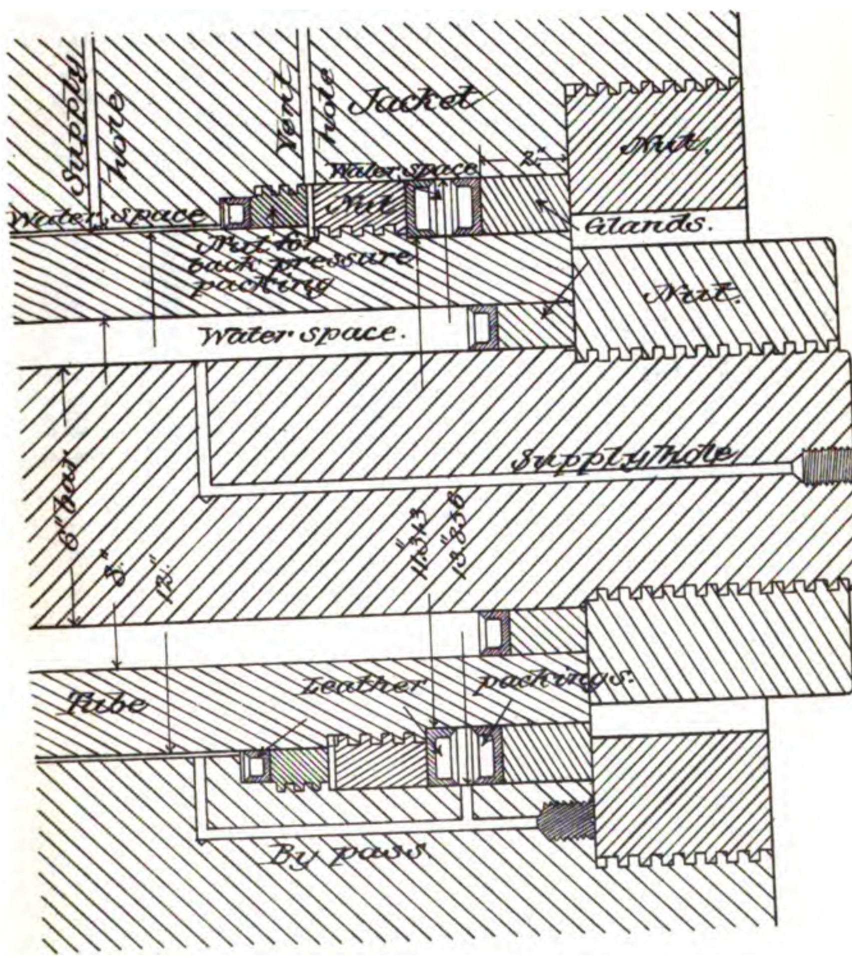


Plate 10.

Hydrostatic test, 8" tube section.

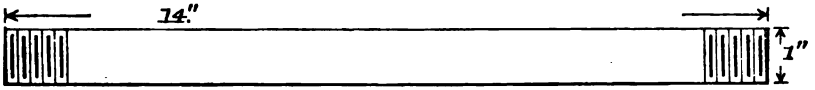
Test with interior and exterior pressures and longitudinal compression combined.



H Ex 92 53 3

Determinations of elastic limit of steel bars at different temperatures.

FORM OF SPECIMENS.



No. 5128

Mark, I.
Diameter, 1".238.
Sectional area, 1.204 square inches.
Gauged length, 10".
Specimen packed in snow and salt and remained in this mixture two hours before testing. Then removed and tested in the open air.
Temperature when tested about 12° F.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,204	1,000	0.	0.	0.	0.	Initial load.
6,020	5,000	.00012	.00012	.....	.....	
12,040	10,000	.00031	.00019	.....	.....	
18,060	15,000	.00050	.00019	.....	.....	
24,080	20,000	.00068	.00018	.....	.....	
30,100	25,000	.00085	.00017	.....	.....	
36,120	30,000	.00103	.00018	.00003	.00003	Elastic limit.
36,120	30,000	.00159	.00056	.....	.....	
37,324	31,000	.00280	.00021	.....	.....	
		.01050	.00770	.....	.....	After 5 minutes.
38,528	32,000	.01200	.00150	.....	.....	
39,732	33,000	.01550	.00350	.....	.....	
40,936	34,000	.02845	.01295	.....	.....	
42,140	35,000	.02970	.00123	.....	.....	
		.03240	.00270	.03093	.03090	Elongation after 5 minutes; test discontinued.

No. 5129.

Mark, I.
Diameter, 1″.238.
Sectional area, 1.204 square inches.
Gauged length, 10″.
Temperature, 70° F.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,204	1,000	0.	0.	0.	0.	Initial load.
6,020	5,000	.00014	.00014	.....	.....	
12,040	10,000	.00032	.00018	.....	.....	
18,060	15,000	.00052	.00020	.....	.....	
24,080	20,000	.00070	.00018	.....	.....	
30,100	25,000	.00086	.00016	.....	.....	
36,120	30,000	.00101	.00015	0.	.....	Elastic limit.
37,324	31,000	.01590	.01489	.....	.....	Elongation in 5 minutes.
.....	.....	.02241	.00651	.02119	.02119	Elongation in 7 minutes.
38,528	32,000	.02300	.00059	.....	.....	
39,732	33,000	.02460	.00160	.....	.....	
40,936	34,000	.02800	.00340	.....	.....	
42,140	35,000	.03175	.00375	.03031	.00912	
42,140	35,000	.03219	.00044	.03073	.00042	
42,140	35,000	.03230	.00011	.....	.....	
		.03256	.00026	.03111	.....	Elongation after 5 minutes; test discontinued.

No. 5130.

Mark, I.
Diameter, 1″.238.
Sectional area, 1.204 square inches.
Gauged length, 10″.
Specimen immersed in hot water for a period of one-half hour before testing. Tested in the open air.
Temperature when tested, about 180° F.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,204	1,000	0.	0.	0.	0.	Initial load.
6,020	5,000	.00011	.00011	.....	.....	
12,040	10,000	.00027	.00016	.....	.....	
18,060	15,000	.00042	.00015	.....	.....	
24,080	20,000	.00060	.00018	—.00009	—.00009	This minus set is attributed to the cooling of the bar.
30,100	25,000	.00072	.00012	.....	.....	
31,304	26,000	.00073	.00001	.....	.....	
32,508	27,000	.00078	.00005	.....	.....	Elastic limit.
33,712	28,000	.00109	.00031	.....	.....	
34,916	29,000	.00450	.00341	.....	.....	
36,120	30,000	.01800	.01350	.....	.....	
		.02212	.00412	.....	.....	After 2 minutes.
37,324	31,000	.02230	.00018	.....	.....	
38,528	32,000	.02370	.00140	.....	.....	
39,732	33,000	.02840	.00470	.....	.....	
40,936	34,000	.03225	.00385	.....	.....	
42,140	35,000	.03490	.00265	.....	.....	
		.03650	.00160	.03501	.03510	Elongation after 5 minutes; test discontinued.

No. 5139.

Mark, S.
Diameter, 1″.238.
Sectional area, 1.204 square inches.
Ganged length, 10″.
Temperature, 70° F.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,204	1,000	0.	0.	0.	0.	Initial load.
6,020	5,000	.00012	.00012	.....	.....	
12,040	10,000	.00031	.00019	.....	.....	
18,060	15,000	.00046	.00015	.....	.....	
24,080	20,000	.00063	.00017	.....	.....	
30,100	25,000	.00081	.00018	.....	.....	
36,120	30,000	.00095	.00014	0.	.....	
37,324	31,000	.00099	.00004	.....	.....	
38,528	32,000	.00102	.00003	.....	.....	
39,732	33,000	.00104	.00002	.....	.....	
40,936	34,000	.00109	.00005	.....	.....	
42,140	35,000	.00112	.00003	—.00001	—.00001	
43,344	36,000	.00114	.00002	.....	.....	
44,548	37,000	.00120	.00006	.....	.....	
45,752	38,000	.00123	.00003	.....	.....	
46,956	39,000	.00135	.00002	.....	.....	
48,160	40,000	.00131	.00006	.....	.....	Elastic limit.
		.00154	.00023	.00020	.00021	Elongation after 5 minutes.
48,160	40,000	.00160	.00006	.....	.....	
49,364	41,000	.00164	.00004	.....	.....	
		.00186	.00022	.00046	.00026	Elongation after 5 minutes; test discontinued.

No. 5140.

Mark, S.
Diameter, 1″.238.
Sectional area, 1.204 square inches.
Gauged length, 10″.
Specimen packed in mixture of snow and salt, where it remained two hours before testing.
Removed from the mixture and tested in the open air.
Temperature when tested about 15° F.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,204	1,000	0.	0.	0.	0.	Initial load.
6,020	5,000	.00013	.00013	.....	.....	
12,040	10,000	.00032	.00019	.....	.....	
18,060	15,000	.00051	.00019	.....	.....	
24,080	20,000	.00069	.00018	.....	.....	
30,100	25,000	.00084	.00015	.....	.....	
36,120	30,000	.00101	.00017	.00001	.00001	
42,140	35,000	.00117	.00016	.....	.....	
43,344	36,000	.00120	.00003	.....	.....	
44,548	37,000	.00122	.00002	.....	.....	
45,752	38,000	.00126	.00004	.....	.....	
46,956	39,000	.00130	.00004	.....	.....	
48,160	40,000	.00132	.00002	.....	.....	Elastic limit.
		.00150	.00018	.00014	.00013	Elongation after 5 minutes.
49,364	41,000	.00153	.00003	.....	.....	
		.00182	.00029	.00044	.00030	Elongation after 5 minutes; test discontinued.

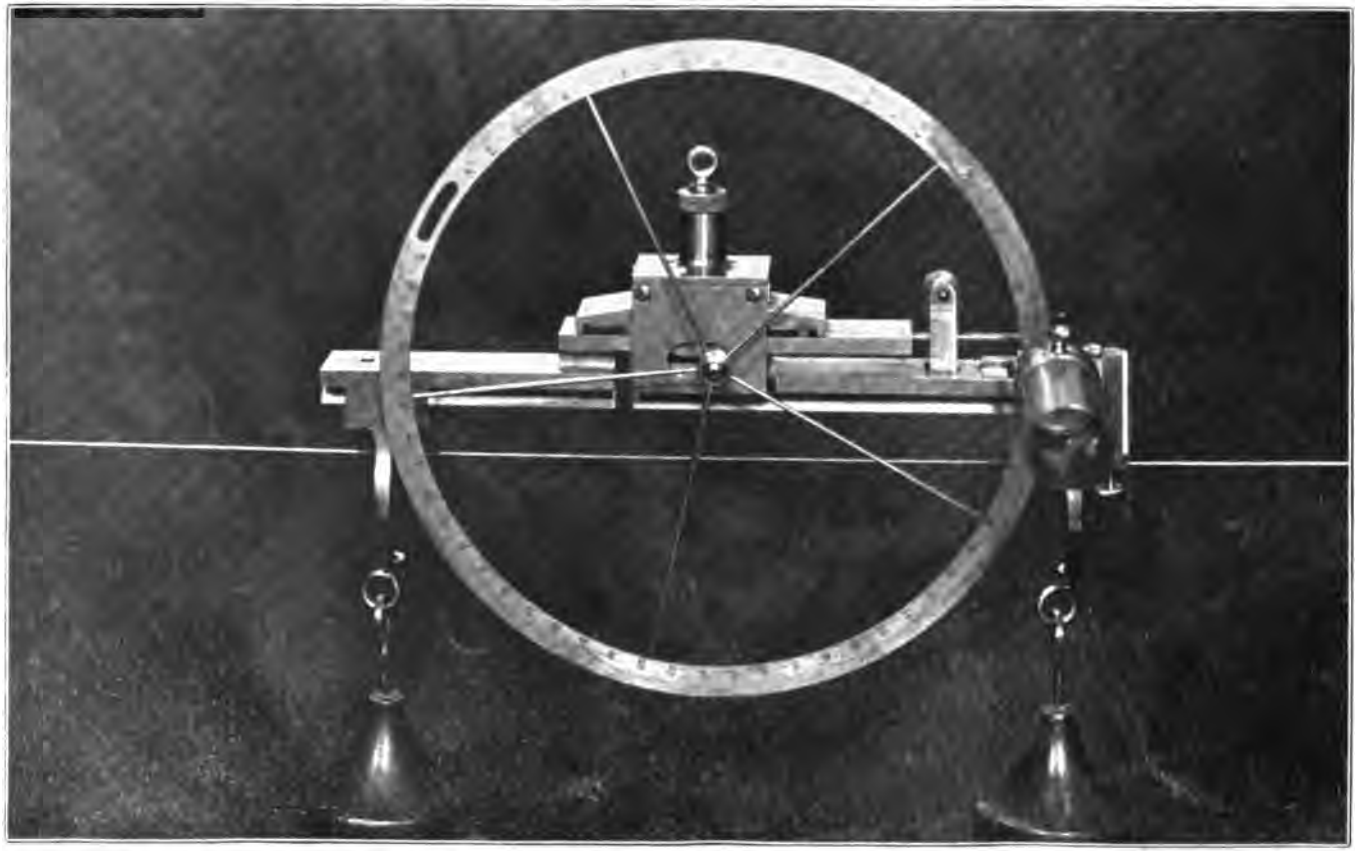
No. 5141.

Mark, S.
Diameter, 1″.238.
Sectional area, 1.204 square inches.
Gauged length, 10″.
Specimen immersed in hot water for a period of three-quarters of an hour before testing.
Tested in the open air.
Temperature when tested about 180° F.

Applied loads.		Elongation per inch.	Successive elongation per inch.	Permanent set.	Successive permanent set.	Remarks.
Total.	Per square inch.					
Pounds.	*Pounds.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
1,204	1,000	0.	0.	0.	0.	Initial load.
6,020	5,000	.00011	.00011			
12,040	10,000	.00027	.00016			
18,060	15,000	.00042	.00015			
24,080	20,000	.00061	.00019			
30,100	25,000	.00079	.00018			
36,120	30,000	.00092	.00013			
42,140	35,000	.00109	.00017	—.00013	—.00013	
43,344	36,000	.00106	—.00003			
44,548	37,000	.00110	.00004			
45,752	38,000	.00111	.00001			
46,956	39,000	.00113	.00002			
		.00115	.00002			Elastic limit.
		.00142	.00027			Elongation after 1 minute.
48,160	40,000	.00152	.00010	+.00012	.00025	Elongation after 5 minutes.
		.00152	0.			
		.00170	.00018			Elongation after 1 minute.
49,364	41,000	.00361	.00191	.00220	.00208	Elongation after 5 minutes; test discontinued.

STEEL MUSIC WIRE.

STEEL MUSIC WIRE.



STEEL MUSIC WIRE.

Photograph of dial micrometer in position for measuring elongation of wire.

STEEL MUSIC WIRE.

The wires here represented were contributed at the World's Columbian Exposition by the manufacturers of the material or by their agents for the purpose of these tests.

The Washburn & Moen Manufacturing Company, of Worcester, Mass., contributed twenty-two coils in commercial packages, labeled "Perfected Steel Music Wire." In sizes the numbers ran from No. 12 to No. 27, music-wire gauge, there being half numbers from 12½ to 17½.

The Trenton Iron Company, of Trenton, N. J., contributed six coils in commercial packages, labeled "Cast-Steel Music Wire." In sizes the numbers ran from No. 13 to No. 18.

Alfred Dolge, of New York, agent for Moritz Poehlmann, of Nuremberg, Germany, contributed eight samples in envelopes, marked "Poehlmann," and the number of the wire gauge. The sizes ran from No. 12 to No. 19.

Hermann Hillger, agent for Stahl & Drahtwerk Roeslau, Roeslau, Germany, contributed five samples in paper wrappers, marked with numbers. There was obviously such a variance in those distinguishing numbers and the actual sizes that the wire-gauge numbers nearest the measured diameters of the samples are used in this report, instead of the numbers found on the wrappers.

The examination and tests of these samples have consisted of measurements of the diameters of the wires, recording the maximum and minimum diameters found. Recording the free diameters of the coils assumed by the wires when unrestrained, it will be understood that these diameters do not refer to the sizes of the coils in which the wire is sold, but represent the curvature of the wires naturally assumed by them.

There were coiling tests, swaging tests, and eyes were formed such as are commonly used for attaching the wires to the wrest pins of pianofortes.

The tensile tests consisted of three tests of each sample, recording the breaking load in actual pounds, also the strength in pounds per square inch of the metal on the actual sectional area.

There were other tests by tension, in which a very complete series of observations was made on the elongations under stresses and the development of permanent sets. Tensile tests of this latter class only were made with wires from Herrmann Hillger, as only a sufficient quantity of wire for one test was contributed.

The accompanying photograph shows the style of automatic micrometer employed as it appeared in position for measuring the elongation of the wire on which it was resting.

The coiling tests, in which each sample was tightly wound in coils in contact with each other around a wire of its own diameter, were made at the United States Government building, World's Columbian Exposition, in the month of October, 1893, at which time some of the swaging tests were also made. The latter tests were made with a succession of blows with a light hand hammer, and were continued until the diameters of the wires were flattened to twice the original dimensions.

The swaging tests were continued and completed at the Watertown Arsenal, Mass., where all of the tensile tests were made.

Eyes were formed on each sample, omitting the half numbers of the Washburn & Moen wires, on an eyeing machine in a commercial manner by the firm of O. J. Faxon & Co., Boston, Mass.

The coiling, swaging, and eyeing tests were successfully made on each sample.

In making the tensile tests the ends of the wires were clamped in the hydraulic jaws of the testing machine, a sheet of fine emery cloth being used directly over the wires.

This method of securing the ends was regarded as satisfactory, as it was a rare occurrence that a wire broke at the jaws.

The micrometer used in determining the elongations and sets carried forked blocks at each end, which blocks straddled the wire, and had sufficient gripping power to actuate the micrometer without injury to the wire. The forked blocks were brought to an edge where contact was made with the wire, establishing a definite gauged length—in these tests 6 inches long.

A sharply defined elastic limit is not shown in this material.

Early permanent sets of small magnitude were developed, which remained for a time with little change, and then under the higher loads gradually increasing in amount.

The tensile strains are necessarily unequal on the different sides of a wire straightened from a circular form, and some of the early sets may properly be attributed to this fact.

An inspection of the details of the tests will show within what limits the sets are immaterial when the wires are used for music purposes.

An investigation has been started for the purpose of experimentally ascertaining the number of vibrations per second of the several sizes of wires under different conditions of tensions and lengths.

Following the tensile tests the strength of eyed samples was investigated.

First the samples which were eyed by the Messrs. O. J. Faxon & Co. were tested, and these tests were followed by the tests of such wires as still retained the eyes which were found on them when the coils were submitted for test by the manufacturers.

The strength of these samples fell considerably below the tensile strength of the plain samples of the wires and were not altogether uniform in strength, and, as it was subsequently shown, also fell below the strength of wires tested over a pin ".16 diameter, representing the wrest pin of a pianoforte.

The eyed samples fractured either at the first twist in the loop or at the inside end of the twisted section, where the standing part of the wire was first bent.

The fractured surfaces, with hardly an exception, were oblique to the axis of the wire, presenting a sheared type of fracture with a comparatively limited contraction of area.

In the direct tensile tests the fractured ends were cup shaped with large contraction of area and presented silky surfaces.

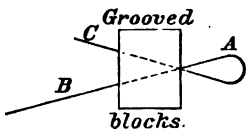
It was evident from the results that the torsional permanent set given the wires in the formation of the eyes was largely responsible for the reduction in strength which the wires displayed at this time.

Any short bend in the wire would tend to cause a reduction in strength at that place, and the strength over a wrest pin would ordinarily be less than that of a straight wire secured by being clamped in the testing machine over several inches in length at each end.

The bending of the wires necessary to twist the two parts together is aggravated in its effect by the torsional stress incident to the common method of forming eyes.

For the purpose of illustrating the strength of eyes simply twisted, without the torsional permanent sets, eyes were formed on the several wires at this arsenal. The manner of making these eyes was as follows:

Grooved blocks were prepared to serve as guides for the two parts of



the wire, the angle made by the two parts of the wire practically fixing the pitch of the twist.

The twisting is begun at the loop A and proceeds toward B and C, as those ends are drawn through the blocks.

A slight pressure is exerted on the wires by the grooved blocks, but not sufficient to prevent the ends B and C rotating synchronously with the loop A.

Eyes thus formed developed greater strength than those in which torsional sets had been given, the results closely agreeing with the strength of wires tested over wrest pins.

The fractured ends of the arsenal-eyed samples were cup shaped and silky in appearance.

The strength of the eyed samples also depends in a measure upon the number of twists per inch given the wire.

The minimum twist necessary to prevent the eye untwisting before breaking the wire seems to be the best adapted for strength. A very coarse pitch, however, untwists unless a greater length of twisted section is employed than is admissible in pianoforte strings.

The common length of the eyes tested was about 2″, including the loop, and the twisting was about three full turns per inch. This was substantially the twist on the original eyes and those eyed by the Messrs. Faxon & Co., the pitch of the coarser wires being a little less and of the finer wires a little greater than this.

The original eyes on the Poehlmann wires ranged from 5½ to 8 full turns per inch. These eyes were inadvertently cut off the coils, and consequently could not be tested to ascertain their strength.

Several pitches of twist were tried with the arsenal-formed eyes on the Washburn & Moen wire No. 18, the results being in favor of the coarser pitches.

Chemical Composition of Steel Music Wire.

WIRE FROM TRENTON IRON COMPANY.

Number of gauge.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.
	Total.	Graphitic.	Combined.					
13	0.868	0.010	0.858	0.095	0.094	0.023	0.017	.....
18	0.880	0.012	0.868	0.422	0.444	0.020	0.021	.....

WIRE FROM WASHBURN & MOEN MANUFACTURING COMPANY.

13	0.868	0.010	0.858	0.342	0.181	0.024	0.031	.....
18	0.874	0.011	0.863	0.294	0.178	0.020	0.031	.....
27	0.850	0.009	0.841	0.207	0.169	0.025	0.033	.....

WIRE FROM MORITZ POEHLMANN.

13	0.703	0.009	0.784	0.167	0.409	0.015	0.029	.....
18	0.863	0.011	0.852	0.154	0.133	0.012	0.020	.....

Music-Wire Gauges.

No.	Washburn & Moen Manufacturing Company.	Trenton Iron Company.	Said to be Poehlmann.
	Inch.	*Inch.*	*Inch.*
00	.....	.0085	.....
0	.....	.009	.....
1	.....	.010	.....
2	.....	.011	.....
3	.....	.012	.....
4	.....	.013	.....
5	.....	.014	.....
6	.....	.016	.....
7	.....	.018	.....
8	.....	.020	.....
9	.....	.022	.....
10	.....	.024	.....
11	.....	.026	.....
12	.0296	.028	.0286
13	.0314	.030	.0315
14	.0326	.032	.0333
15	.0345	.034	.0354
16	.0360	.036	.0369
17	.0377	.038	.0390
18	.0395	.040	.0410
19	.0414	.042	.0430
20	.0434	.044	.0450
21	.0460	.046	.0468
22	.0483	.048	.0490
23	.0515	.051	.0518
24	.0550	.055	.0560
25	.0586	.059	.0595
26	.0626	.063	.0632
27	.0669	.067	.0685
28	.....	.071	.....
29	.....	.074	.....
30	.....	.078	.....
31	.....	.082	.....
32	.....	.086	.....

MEASUREMENT OF COILS.

Wire submitted by the Washburn & Moen Manufacturing Company, Worcester, Mass.

No. of gauge.	Actual diameter of wire.	Free diameter of coil.	Remarks.
	Inch.	*Inches.*	
27	.0655	31	
26	.0622	34	
25	.0577	31	
24	.0542	42	Has a flat side ".0539 diameter.
23	.0503	30	There were places where the diameter was ".0507±.
22	.0478	39	
21	.0456	40	
20	.0435	20	
19	.0415	About 15	
18	.0391	21	
17½	.0386	21	
17	.0374	17	
16½	.0366	About 32	
16	.0358	.....	Took a long spiral shape, 32" pitch, 5½" diameter.
15½	.0346	24	
15	.0342	28	
14½	.0336	12	
14	.0328	12	
13½	.0317	12	
13	.0309	11	
12½	.0305+	20	
12	.0284	21	

Wire submitted by the Trenton Iron Company, Trenton, N. J.

No. of gauge.	Actual diameter of wire.	Free diameter of coil.	Remarks.
	Inch.	*Inches.*	
18	.0398	8½	
17	.0375	8½	
16	.0362	10½	
15	.0342	6	
14	.0321	.....	Took a long spiral shape, 30" pitch 7" diameter.
13	.0301	10	

Wire submitted by Alfred Dolge, agent for Moritz Poehlmann, Nuremberg, Germany.

No. of gauge.	Actual diameter of wire.	Free diameter of coil.	Remarks.
	Inch.	*Inches.*	
19	.0417	11½	
18	.0402	9	
17	.0381	17	
16	.0361	11	
15	.0342	14	
14	.0323	17	
13	.0303	17	
12	.0284	8	

Wire submitted by Hermann Hillger, agent for Stahl und Drahtwerk Roeslau, Roeslau, Germany.

No. of gauge.	Actual diameter of wire.	Free diameter of coil.	Remarks.
	Inch.	*Inches.*	
20	.0448	13±	
16	.0353	8	
16	.0368	10	
15	.0341	10	
14	.0320	11	

TENSILE TESTS.

Wire submitted by the Washburn & Moen Manufacturing Company, Worcester, Mass.

No. of test.	No. of gauge.	Diameter.			Sectional area.	Tensile strength.		Fractured.
		Maximum.	Minimum.	Mean.		Total.	Per square inch.	
		Inch.	*Inch.*	*Inch.*	*Sq. inch.*	*Pounds.*	*Pounds.*	
6345	27	.0655	.0652	.0654	.003359	1,098	326,880	9½″ from jaws.
6346	27	.....	.....	.0654	.003359	1,079	321,230	8¾″ from jaws.
6347	27	.....	.....	.0654	.003359	1,072	319,140	2″ from jaws.
6348	26	.0623	.0620	.0622	.003039	997	328,070	3½″ from jaws.
6349	26	.....	.....	.0621	.003029	980	323,540	7″ from jaws.
6350	26	.....	.....	.0621	.003029	968	319,580	7½″ from jaws.
6351	25	.0578	.0570	.0577	.002615	819	313,190	8½″ from jaws.
6352	25	.....	Flatside	.0576	.002606	818	313,890	9½″ from jaws.
6353	25	.....	.....	.0576	.002606	812	311,590	3½″ from jaws.
6354	24	.0546	.0536	.0542	.002307	723	313,390	5½″ from jaws.
6355	24	.....	.....	.0542	.002307	725	314,260	5½″ from jaws.
6356	24	.....	.....	.0542	.002307	731	316,860	4″ from jaws.

Nos. 6357 and 6358 were tested warm, 145° F.

The middle part of No. 6359 was cooled in mixture of snow and salt Fracture occurred at the jaws where the wire was nearer the temperature of the machine, or about 60° F.

No. of test.	No. of gauge.	Diameter.			Sectional area.	Tensile strength.		Fractured.
		Maximum.	Minimum.	Mean.		Total.	Per square inch.	
		Inch.	*Inch.*	*Inch.*	*Sq. inch.*	*Pounds.*	*Pounds.*	
6357	24	.0543	.0543	.0543	.002316	704	303,970	7¼″ from jaws.
6358	24	.....	.....	.0543	.002316	712	307,430	7″ from jaws.
9359	24	.....	.....	.0543	.002316	731	315,630	Face of jaws.
6360	23	.0505	.0500	.0503	.001987	649	326,620	1½″ from jaws.
6361	23	.....	.....	.0503	.001987	634	319,070	8″ from jaws.
6362	23	.....	.....	.0503	.001987	647	325,620	1¼″ from jaws.
6363	22	.0482	.0476	.0479	.001802	627	347,950	¼″ from jaws.
6364	22	.....	.....	.0479	.001802	624	346,280	6″ from jaws.
6365	22	.....	.....	.0479	.001802	620	344,060	1½″ from jaws.
6366	21	.0456	.0456	.0456	.001633	561	343,540	3″ from jaws.
6367	21	.....	.....	.0456	.001633	575	352,110	5″ from jaws.
6368	21	.....	.....	.0456	.001633	569	348,440	3¾″ from jaws.
6369	20	.0436	.0434	.0435	.001486	529	355,990	Middle of length.
6370	20	.....	.....	.0435	.001486	534	359,350	6″ from jaws.
6371	20	.....	.....	.0435	.001486	534	359,350	8¼″ from jaws.
6372	19	.0514	.0414	.0414	.001346	491	364,780	8″ from jaws.
6373	19	.....	.....	.0414	.001346	489	363,300	7″ from jaws.
6374	19	.....	.....	.0414	.001346	489	363,300	2¼″ from jaws.
6375	18	.0390	.0388	.0389	.001188	448	377,100	5″ from jaws.
6376	18	.....	.....	.0389	.001188	457	384,680	1¼″ from jaws.
6377	18	.....	.....	.0389	.001188	453	381,310	3¼″ from jaws.
6378	17½	.0387	.0385	.0386	.001170	428	365,810	8″ from jaws.
6379	17½	.....	.....	.0386	.001170	428	365,810	5″ from jaws.
6380	17½	.....	.....	.0386	.001170	438	374,360	4″ from jaws.
6381	17	.0376	.0374	.0375	.001104	432	391,300	3″ from jaws.
6382	17	.....	.....	.0375	.001104	431	390,400	Do.
6383	17	.....	.....	.0375	.001104	432	391,300	8″ from jaws.
6384	16½	.0368	.0365	.0366	.001052	425	403,990	Middle of length.
6385	16½	.....	.....	.0366	.001052	417	396,390	4″ from jaws.
6386	16½	.....	.....	.0366	.001052	420	399,240	Do.
6387	16	.0359	.0357	.0358	.001007	392	389,280	1″ from jaws.
6388	16	.....	.....	.0358	.001007	397	394,240	2¼″ from jaws.
6389	16	.....	.....	.0358	.001007	401	398,210	9½″ from jaws.
6390	15½	.0347	.0344	.0345	.000935	360	385,030	At jaws.
6391	15½	.....	.....	.0345	.000935	364	389,300	4″ from jaws.
6392	15½	.....	.....	.0345	.000935	359	383,960	Middle of length.
6393	15	.0342	.0338	.0340	.000908	338	372,250	8½″ from jaws.
6394	15	.....	.....	.0340	.000908	345	379,960	2″ from jaws.
6395	15	.....	.....	.0340	.000908	343	377,750	7¾″ from jaws.
6396	14½	.0335	.0335	.0335	.000881	336	381,380	8¼″ from jaws.
6397	14½	.....	.....	.0335	.000881	332	376,840	4½″ from jaws.
6398	14½	.....	.....	.0335	.000881	334	379,110	5½″ from jaws.
6399	14	.0328	.0326	.0327	.000840	331	394,050	4″ from jaws.
6400	14	.....	.....	.0327	.000840	334	397,620	2″ from jaws.
6401	14	.....	.....	.0327	.000840	338	402,380	5″ from jaws.
6402	13½	.0317	.0315	.0316	.000784	313	399,230	3¼″ from jaws.
6403	13½	.....	.....	.0316	.000784	317	404,330	8″ from jaws.
6404	13½	.....	.....	.0316	.000784	319	406,890	3″ from jaws.
6405	13	.0312	.0308	.0310	.000755	303	401,320	2¼″ from jaws.
6406	13	.....	.....	.0310	.000755	306	405,300	3½″ from jaws.
6407	13	.....	.....	.0310	.000755	304	402,650	8″ from jaws.
6408	12½	.0306	.0304	.0305	.000731	287	392,610	7″ from jaws.
6409	12½	.....	.....	.0305	.000731	292	399,450	Do.
6410	12½	.....	.....	.0305	.000731	299	409,040	Do.
6411	12	.0286	.0284	.0285	.000638	262	410,660	3¼″ from jaws.
6412	12	.....	.....	.0285	.000638	263	412,230	2″ from jaws.
6413	12	.....	.....	.0285	.000638	263	412,230	4″ from jaws.

Wire submitted by the Trenton Iron Company, Trenton, N. J.

No. of test.	No. of gauge.	Diameter.			Sectional area.	Tensile strength.		Fractured.
		Maximum.	Minimum.	Mean.		Total.	Per square inch.	
		Inch.	*Inch.*	*Inch.*	*Sq. inch.*	*Pounds.*	*Pounds.*	
6414	18	.0400	.0393	.0397	.001238	452	365,100	4″ from jaws.
6415	18	.....	.....	.0397	.001238	459	370,760	8½″ from jaws.
6416	18	.....	.....	.0397	.001238	455	367,530	5″ from jaws.
6417	17	.0377	.0375	.0376	.001110	408	367,570	Do.
6418	17	.....	.....	.0376	.001110	411	370,270	2½″ from jaws.
6419	17	.....	.....	.0376	.001110	404	363,960	8″ from jaws.
6420	16	.0362	.0359	.0361	.001024	386	376,950	3½″ from jaws.
6421	16	.....	.....	.0361	.001024	387	377,930	6″ from jaws.
6422	16	.....	.....	.0361	.001024	380	371,090	4½″ from jaws.
6423	15	.0343	.0338	.0341	.000913	355	388,830	5½″ from jaws.
6424	15	.....	.....	.0341	.000913	360	394,308	9″ from jaws.
6425	15	.....	.....	.0341	.000913	357	391,020	8½″ from jaws.
6426	14	.0322	.0318	.0320	.000804	327	406,720	At jaws.
6427	14	.....	.....	.0320	.000804	326	405,470	5½″ from jaws.
6428	14	.....	.....	.0320	.000804	324	402,990	3″ from jaws.
6429	13	.0303	.0300	.0302	.000716	304	424,580	5½″ from jaws.
6430	13	.....	.....	.0302	.000716	299	417,600	5″ from jaws.
6431	13	.....	.....	.0302	.000716	296	413,410	8½″ from jaws.

Wire submitted by Alfred Dolge, agent for Moritz Poehlmann, Nuremberg, Germany.

No. of test.	No. of gauge.	Diameter.			Sectional area.	Tensile strength.		Fractured.
		Maximum.	Minimum.	Mean.		Total.	Per square inch.	
		Inch.	*Inch.*	*Inch.*	*Sq. inch.*	*Pounds.*	*Pounds.*	
6432	19	.0420	.0418	.0419	.001379	494	358,230	Middle of length.
6433	19	.....	.....	.0419	.001379	472	342,270	2″ from jaws.
6434	19	.....	.....	.0419	.001379	512	371,280	5″ from jaws.
6435	18	.0402	.0399	.0401	.001263	440	348,380	1″ from jaws.
6436	18	.....	.....	.0401	.001263	430	340,460	Do.
6437	18	.....	.....	.0401	.001263	462	365,800	9½″ from jaws.
6438	17	.0381	.0379	.0380	.001134	448	395,060	3½″ from jaws.
6439	17	.....	.....	.0380	.001134	439	387,120	2″ from jaws.
6440	17	.....	.....	.0380	.001134	452	398,590	8½″ from jaws.
6441	16	.0362	.0361	.0361	.001024	421	411,130	7″ from jaws.
6442	16	.....	.....	.0361	.001024	416	406,250	At jaws.
6443	16	.....	.....	.0361	.001024	420	410,160	6½″ from jaws.
6444	15	.0344	.0342	.0343	.000924	344	372,290	9½″ from jaws.
6445	15	.....	.....	.0343	.000924	345	373,380	6″ from jaws.
6446	15	.....	.....	.0343	.000924	370	400,430	5″ from jaws.
6447	14	.0325	.0323	.0324	.000824	329	399,270	8″ from jaws.
6448	14	.....	.....	.0324	.000824	343	416,260	At jaws.
6449	14	.....	.....	.0324	.000824	326	395,630	2″ from jaws.
6450	13	.0304	.0302	.0303	.000721	301	417,470	At jaws.
6451	13	.....	.....	.0303	.000721	309	428,570	Do.
6452	13	.....	.....	.0303	.000721	310	429,960	3″ from jaws.
6453	12	.0284	.0284	.0284	.000633	281	443,920	1″ from jaws.
6454	12	.....	.....	.0284	.000633	293	462,870	At jaws.
6455	12	.....	.....	.0284	.000633	286	451,820	Do.

Wire submitted by Hermann Hillger, agent for Stahl und Drahtwerk Roeslau, Roeslau, Germany.

[Tabulation of the tests of specimens on which elongations were measured.]

No. of test.	No. of gauge.	Diameter.			Sectional area.	Tensile strength.		Fractured.
		Maximum.	Minimum.	Mean.		Total.	Per square inch.	
		Inch.	*Inch.*	*Inch.*	*Sq. inch.*	*Pounds.*	*Pounds.*	
6340	20	.0451	.0444	.0448	.001576	497	315,360	3½″ from jaws.
6342	16	.0354	.0353	.0353	.000979	364	371,810	2″ from jaws.
6343	16	.0372	.0364	.0368	.001064	364	342,100	At jaws.
6341	15	.0344	.0338	.0341	.000913	320	350,490	9½″ from jaws.
6344	14	.0321	.0318	.0320	.000804	236	293,530	8½″ from jaws.

TENSILE TESTS, WITH DETAILS OF ELONGATIONS AND PERMANENT SETS.

Wire submitted by the Washburn & Moen Manufacturing Company, Worcester, Mass.

No. 6304.

No. 27 gauge.
Diameter, ".0655.
Sectional area, .003369 square inch.
Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
60	.....	.0016	.....	
80	.....	.0030	.....	
100	.....	.0046	.....	
120	.....	.0056	.....	
140	.....	.0069	.....	
160	.....	.0078	.....	
180	.....	.0094	.....	
200	.....	.0108	.0001	
220	.....	.0121	.....	
240	.....	.0135	.....	
260	.....	.0146	.....	
280	.....	.0156	.....	
300	.....	.0169	.0004	
320	.....	.0181	.....	
340	.....	.0195	.....	
360	.....	.0209	.....	
380	.....	.0221	.....	
400	.....	.0235	.0005	
420	.....	.0249	.....	
440	.....	.0266	.....	
460	.....	.0278	.....	
480	.....	.0290	.....	
500	.....	.0305	.0013	
520	.....	.0320	.....	
540	.....	.0335	.....	
560	.....	.0351	.....	
580	.....	.0367	.....	
600	.....	.0378	.0025	
620	.....	.0395	.....	
640	.....	.0412	.....	
660	.....	.0426	.....	
680	.....	.0442	.....	
700	.....	.0465	.0040	
720	.....	.0482	.....	
740	.....	.0504	.....	
760	.....	.0531	.....	
780	.....	.0548	.....	
800	.....	.0565	.0072	
820	.....	.0595	.....	
840	.....	.0619	.....	
860	.....	.0645	.....	
880	.....	.0672	.....	
900	.....	.0707	.0137	
920	.....	.0750	.....	
940	.....	.0784	.....	
960	.....	.0828	.....	
980	.....	.0877	.....	
1,000	.....	.0967	.....	
900	.....	.0904	.....	
800	.....	.0835	.....	
700	.....	.0769	.....	
600	.....	.0707	.....	
500	.....	.0640	.....	
400	.....	.0577	.....	
300	.....	.0510	.....	
200	.....	.0440	.....	
100	.....	.0368	.....	
40	.....	.....	.0322	
100	.....	.0365	.....	
200	.....	.0428	.....	

No. 6304—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
300	.....	.0495	.....	
400	.....	.0557	.....	
500	.....	.0625	.....	
600	.....	.0692	.....	
700	.....	.0759	.....	
800	.....	.0828	.....	
900	.....	.0906	.....	
1,040	.....	.12	.....	
1,047	310,770	.....	.....	Tensile strength.

Fractured 4¾″ from jaws of the machine. Appearance, fine silky. Cup-shaped ends.

Diameter at fracture, ″.048. Area, .001810 square inch. Contraction of area, 46.3 per cent.

No. 6305.

No. 26 gauge.
Diameter, .0622 square inch.
Sectional area, .003039 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0051	.0002	
200	.....	.0122	.0002	
300	.....	.0196	.0004	
400	.....	.0276	.0008	
500	.....	.0351	.0022	
520	.....	.0375	.....	
540	.....	.0389	.....	
560	.....	.0406	.....	
580	.....	.0424	.....	
600	.....	.0442	.0036	
620	.....	.0463	.....	
640	.....	.0478	.....	
660	.....	.0496	.....	
680	.....	.0520	.....	
700	.....	.0543	.0062	
720	.....	.0574	.....	
740	.....	.0594	.....	
760	.....	.0623	.....	
780	.....	.0653	.....	
800	.....	.0685	.0113	
820	.....	.0723	.....	
840	.....	.0752	.....	
860	.....	.0795	.....	
880	.....	.0842	.....	
900	.....	.0898	.0217	
940	.....	.10	.....	
980	.....	.12	.....	
998	328,400	.....	.....	Tensile strength.

Fractured 3½″ from jaws. Appearance, fine silky. Cup shaped ends.
Diameter at fracture, ″.048. Area, .001810 square inch.
Contraction of area, 40.4 per cent.

No. 6306.

No. 25 gauge.
Diameter, ″.0577.
Sectional area, .002615 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0058	.0002	
200	.....	.0146	.0002	
300	.....	.0223	.0009	
400	.....	.0316	.0016	
500	.....	.0415	.0029	
520	.....	.0450	.....	
540	.....	.0463	.....	
560	.....	.0489	.....	
580	.....	.0512	.....	
600	.....	.0540	.0065	
620	.....	.0564	.....	
640	.....	.0591	.....	
660	.....	.0627	.....	
680	.....	.0661	.....	
700	.....	.0698	.0132	
720	.....	.0752	.....	
740	.....	.0791	.....	
760	.....	.0852	.....	
780	.....	.0936	.....	
800	.....	.1039	.0359	
838	320,460	.....	.....	Tensile strength.

Fractured 11½″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.141. Area, .001320 square inch.
Contraction of area, 49.5 per cent.

No. 6307.

No. 24 gauge.
Diameter, ".0542.
Sectional area, .002307 square inch.
Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0061	.0002	
200	.....	.0157	.0008	
300	.....	.0260	.0011	
400	.....	.0373	.0028	
420	.....	.0390	.....	
440	.....	.0409	.....	
460	.....	.0435	.....	
480	.....	.0461	.....	
500	.....	.0490	.0048	
520	.....	.0522	.....	
540	.....	.0553	.....	
560	.....	.0586	.....	
580	.....	.0622	.....	
600	.....	.0671	.0128	
620	.....	.0728	.....	
640	.....	.0771	.....	
660	.....	.0844	.....	
680	.....	.0945	.....	
700	.....	.1068	.0391	
720	.....	.12	.....	
736	319,030	.....	.....	Tensile strength.

Fractured 10" from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ".040. Area, .001257 square inch.
Contraction of area, 45.5 per cent.

No. 6308.

No. 23 gauge.
Diameter ".0503.
Sectional area, .001987 square inch.
Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0073	.0003	
200	.....	.0181	.0006	
300	.....	.0292	.0014	
320	.....	.0320	.....	
340	.....	.0341	.....	
360	.....	.0367	.....	
380	.....	.0394	.....	
400	.....	.0421	.0039	
420	.....	.0454	.....	
440	.....	.0481	.....	
460	.....	.0515	.....	
480	.....	.0551	.....	
500	.....	.0591	.0087	
520	.....	.0640	.....	
540	.....	.0689	.....	
560	.....	.0741	.....	
580	.....	.0818	.....	
600	.....	.0895	.0257	
620	.....	.10	.....	
640	.....	.11	.....	
651	327,630	.....	.....	Tensile strength.

Fractured 4" from neck. Appearance, fine silky. Cup shaped.
Diameter at fracture, ".035. Area, .000962 square inch.
Contraction of area, 51.6 per cent.

No. 6309.

No. 22 gauge.
Diameter, ″.0478.
Sectional area, .001795 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0072	.0002	
200	.....	.0194	.0005	
300	.....	.0320	.0013	
320	.....	.0349	.....	
340	.....	.0375	.....	
360	.....	.0401	.....	
380	.....	.0428	.....	
400	.....	.0464	.0036	
420	.....	.0506	.....	
440	.....	.0538	.....	
460	.....	.0579	.....	
480	.....	.0625	.....	
500	.....	.0684	.0117	
520	.....	.0749	.....	
540	.....	.0815	.....	
560	.....	.0928	.0276	
580	.....	.10	.....	
597	332,590	.....	.....	Tensile strength.

Fractured 7″ from the jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.035. Area, .000962 square inch.
Contraction of area, 46.4 per cent.

No. 6310.

No. 21 gauge.
Diameter, ″.0456.
Sectional area, .001633 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0067	.0002	
200	.....	.0220	.0002	
300	.....	.0355	.0006	
320	.....	.0385	.....	
340	.....	.0415	.....	
360	.....	.0449	.....	
380	.....	.0484	.....	
400	.....	.0516	.0037	
420	.....	.0571	.....	
440	.....	.0610	.....	
460	.....	.0656	.....	
480	.....	.0707	.....	
500	.....	.0784	.0137	
520	.....	.0871	.....	
540	.....	.0966	.0270	
560	.....	.11	.....	
572	350,280	.....	.....	Tensile strength.

Fractured 12″ from the jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.035. Area, .000962 square inch.
Contraction of area, 41.1 per cent.

No. 6311.

No. 20 gauge.
Diameter, ″.0435.
Sectional area, .001486 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0090	0.	
200	.....	.0230	0.	
300	.....	.0378	0.	
320	.....	.0410	.....	
340	.....	.0451	.....	
360	.....	.0485	.....	
380	.....	.0520	.....	
400	.....	.0556	.0010	
420	.....	.0606	.....	
440	.....	.0646	.....	
460	.....	.0696	.....	
480	.....	.0755	.....	
500	.....	.0842	.0104	
520	.....	.09	.....	
540	.....	.10	.....	
542	364,740	.....	.....	Tensile strength.

Fractured 10½″ from the jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.035. Area, .000962 square inch.
Contraction of area, 35.3 per cent.

No. 6312.

No. 19 gauge.
Diameter, ".0415.
Sectional area, .001353 square inch.
Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0091	0.	
200	.....	.0259	0.	
300	.....	.0433	.0020	
320	.....	.0494	.....	
340	.....	.0523	.....	
360	.....	.0562	.....	
380	.....	.0628	.....	
400	.....	.0705	.0118	
400	.....	.0754	.0149	
440	.....	.09	.....	
488	360, 680	.....	.....	Tensile strength.

Fractured 12" from the jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ".030. Area, .000707 square inch.
Contraction of area, 47.7 per cent.

No. 6313.

No. 18 gauge.
Diameter, ".0391.
Sectional area, .001201 square inch.
Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0118	.0003	
200	.....	.0308	.0012	
220	.....	.0345	.....	
240	.....	.0380	.....	
260	.....	.0417	.....	
280	.....	.0457	.....	
300	.....	.0509	.0040	
320	.....	.0571	.....	
340	.....	.0616	.....	
360	.....	.0677	.....	
380	.....	.0777	.0155	
400	.....	.09	.....	
420	.....	.10	.....	
440	.....	.12	.....	
472	393, 010	.....	.....	Tensile strength.

Fractured 10" from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ".026. Area, .000531 square inch.
Contraction of area, 55.8 per cent.

No. 6314.

No. 17½ gauge.
Diameter, ″.0386.
Sectional area, .001170 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0118	0.	
200	.....	.0293	0.	
220	.....	.0340	.....	
240	.....	.0365	.....	
260	.....	.0409	.....	
280	.....	.0455	.....	
300	.....	.0508	.0032	
320	.....	.0585	.....	
340	.....	.0631	.....	
360	.....	.0695	.....	
380	.....	.0790	.....	
400	.....	.0894	.0204	
420	.....	.10	.....	
446	381,200	.12	.....	Tensile strength.

Fractured 10″ from the jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.029. Area, .000661 square inch.
Contraction of area, 43.5 per cent.

No. 6315.

No. 17 gauge.
Diameter, ″.0374.
Sectional area, .001099 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0122	.0002	
200	.....	.0326	.0006	
220	.....	.0363	.....	
240	.....	.0405	.....	
260	.....	.0444	.....	
280	.....	.0495	.....	
300	.....	.0554	.0047	
320	.....	.0631	.....	
340	.....	.0676	.....	
360	.....	.0746	.....	
380	.....	.0842	.....	
400	.....	.1024	.0285	
422	383,990	.....	.....	Tensile strength.

Fractured 11″ from the jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.024. Area, .000452 square inch.
Contraction of area, 58.9 per cent.

No. 6316.

No. 16½ gauge.
Diameter ″.0366.
Sectional area .001052 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0127	0.	
200	.....	.0335	.0006	
220	.....	.0374	.....	
240	.....	.0415	.....	
260	.....	.0461	.....	
280	.....	.0511	.....	
300	.....	.0576	.0045	
320	.....	.0650	.....	
340	.....	.0707	.....	
360	.....	.0798	.....	
380	.....	.0882	.....	
400	.....	.1091	.0337	
421	400,190	.....	.....	Tensile strength.

Fractured at middle of length. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.026. Area, .000531 square inch.
Contraction of area, 49.5 per cent.

No. 6317.

No. 16 gauge.
Diameter, ″.0358.
Sectional area, .001007 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0128	0.	
200	.....	.0351	0.	
220	.....	.0375	.....	
240	.....	.0421	.....	
260	.....	.0468	.....	
280	.....	.0529	.....	
300	.....	.0591	.0046	
320	.....	.0680	.....	
340	.....	.0735	.....	
360	.....	.0830	.....	
380	.....	.1008	.0263	
404	401,190	.....	.....	Tensile strength.

Fractured 6″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.024. Area, .000452 square inch.
Contraction of area, 55.1 per cent.

No. 6318.

No. 15½ gauge.
Diameter, .″0346.
Sectional area, .000940 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0140	.0007	
200	.....	.0403	.0015	
220	.....	.0444	.....	
240	.....	.0497	.....	
260	.....	.0561	.....	
280	.....	.0631	.....	
300	.....	.0752	.0122	
357	379,790	.....	.....	Tensile strength.

Fractured 7″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.026. Area, .000531 square inch.
Contraction of area, 43.5 per cent.

No. 6319.

No. 15 gague.
Diameter, ″.0342.
Sectional area, .000919 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0148	.0003	
200	.....	.0401	.0014	
220	.....	.0446	.....	
240	.....	.0506	.....	
260	.....	.0583	.....	
280	.....	.0700	.....	
300	.....	.0810	.0193	
346	376,500	.....	.....	Tensile strength.

Fractured 3½″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.026. Area, .000531 square inch.
Contraction of area, 42.2 per cent.

No. 6320.

No. 14½ gauge.
Diameter, ″.0336.
Sectional area, .000887 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0145	.0006	
200	.....	.0416	.0035	
220	.....	.0490	.....	
240	.....	.0560	.....	
260	.....	.0656	.....	
280	.....	.0804	.....	
300	.....	.0969	.0305	
331	373,170	.....	.....	Tensile strength.

Fractured at face of jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.024. Area, .000452 square inch.
Contraction of area, 49 per cent.

No. 6321.

No. 14 gauge.
Diameter, ″.0328.
Sectional area, .000845 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0152	.0003	
120	.....	.0213	.....	
140	.....	.0256	.....	
160	.....	.0312	.....	
180	.....	.0363	.....	
200	.....	.0424	.0026	
220	.....	.0498	.....	
240	.....	.0566	.....	
260	.....	.0650	.....	
280	.....	.0774	.....	
300	.....	.0906	.0228	
333	394,080	.....	.....	Tensile strength.

Fractured 4″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.025. Area, .000491 square inch.
Contraction of area, 41.9 per cent.

No. 6322.

No. 13½ gauge.
Diameter, ″.0317.
Sectional area, .0007?9 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0164	.0001	
120	.....	.0227	.....	
140	.....	.0279	.....	
160	.....	.0337	.....	
180	.....	.0400	.....	
200	.....	.0473	.0043	
220	.....	.0565	.....	
240	.....	.0640	.....	
260	.....	.0747	.....	
280	.....	.0917	.0224	
318	403,040	.....	.....	Tensile strength.

Fractured 12″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.024. Area, .000452 square inch.
Contraction of area, 42.7 per cent.

No. 6323.

No. 13 gauge.
Diameter, ″.0309.
Sectional area, ″.000750 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0178	0.	
120	.....	.0233	.....	
140	.....	.0290	.....	
160	.....	.0354	.....	
180	.....	.0415	.....	
200	.....	.0479	.0029	
220	.....	.0560	.....	
240	.....	.0637	.....	
260	.....	.0775	.....	
280	.....	.0930	.0186	
309	412,000	.....	.....	Tensile strength.

Fractured 4½″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, .020. Area, .000314 square inch.
Contraction of area, 58.1 per cent.

No. 6324.

No. 12½ gauge.
Diameter, ″.0305+.
Sectional area, .000731 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0187	.0005	
120	.....	.0234	.....	
140	.....	.0290	.....	
160	.....	.0350	.....	
180	.....	.0421	.....	
200	.....	.0492	.0023	
220	.....	.0605	.....	
240	.....	.0689	.....	
260	.....	.0855	.0182	
297	406,290	.....	.....	Tensile strength.

Fractured 4½″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.023. Area, .000415 square inch.
Contraction of area, 43.2 per cent.

No. 6325.

No. 12 gauge.
Diameter, ″.0284.
Sectional area, .000633 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0203	.0005	
120	.....	.0270	.....	
140	.....	.0345	.....	
160	.....	.0423	.....	
180	.....	.0517	.....	
200	.....	.0681	.0110	
210	.....	.0764	.....	
220	.....	.0800	.....	
230	.....	.0929	.....	
263	415,480	.....	.....	Tensile strength.

Fractured 3″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.020. Area, .000314 square inch.
Contraction of area, 50.4 per cent.

Wire submitted by the Trenton Iron Company, Trenton, N. J.

No. 6326.

No. 18 gauge.
Diameter, ".0398.
Sectional area, .001244 square inch.
Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0104	.0001	
160	.....	.0222	.....	
180	.....	.0262	.....	
200	.....	.0295	.0005	
220	.....	.0344	.....	
260	.....	.0415	.....	
280	.....	.0455	.....	
300	.....	.0499	.0025	
320	.....	.0562	.....	
340	.....	.0614	.....	
360	.....	.0665	.....	
380	.....	.0717	.....	
400	.....	.0802	.0145	
400	.....	.0836	.0179	Second application of load.
400	.....	.0845	.0186	Third application of load.
440	.....	.10	.....	
460	.....	.13	.....	
463	372, 180	.....	.....	Tensile strength.

Fractured 7½" from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ".029. Area, .000661 square inch.
Contraction of area, 46.9 per cent.

No. 6327.

No. 17 gauge.
Diameter, ".0375.
Sectional area, .001104 square inch.
Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
180	.....	.0126	.0006	
200	.....	.0325	.0019	
220	.....	.0375	.....	
240	.....	.0420	.....	
260	.....	.0474	.....	
280	.....	.0529	.....	
300	.....	.0595	.0075	
320	.....	.0663	.....	
340	.....	.0720	.....	
360	.....	.0816	.....	
380	.....	.0960	.....	
404	365, 940	.....	.....	Tensile strength.

Fractured 7" from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ".028. Area, .000616 square inch.
Contraction of area, 44.2 per cent.

No. 6328.

No. 16 gauge.
Diameter, ″.0362.
Sectional area, .001029 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0133	.0003	
200	.....	.0367	.0011	
220	.....	.0418	.....	
240	.....	.0470	.....	
260	.....	.0526	.....	
280	.....	.0584	.....	
300	.....	.0655	.0078	
320	.....	.0738	.....	
340	.....	.0870	.0198	
382	371,230	.....	.....	Tensile strength.

Fractured 6″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.026. Area, .000531 square inch.
Contraction of area, 48.4 per cent.

No. 6329.

No. 15 gauge.
Diameter, ″.0342.
Sectional area, .000919 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0144	0.	
200	.....	.0411	.0025	
220	.....	.0462	.....	
240	.....	.0524	.....	
260	.....	.0590	.....	
280	.....	.0671	.....	
300	.....	.0771	.0138	
346	376,500	.....	.....	Tensile strength.

Fractured 7″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.024. Area, .000452 square inch.
Contraction of area, 50.8 per cent.

No. 6330.

No. 14 gauge.
Diameter, ″.0321.
Sectional area, .000809 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0162	0.	
120	.....	.0217	.....	
140	.....	.0271	.....	
160	.....	.0320	.....	
180	.....	.0382	.....	
200	.....	.0440	.0011	
220	.....	.0502	.....	
240	.....	.0570	.....	
260	.....	.0650	.....	
280	.....	.0740	.....	
300	.....	.0953	.0219	
333	411,620	.....	.....	Tensile strength.

Fractured at face of jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.023. Area, .000415 square inch.
Contraction of area, 48.7 per cent.

No. 6331.

No. 13 gauge.
Diameter, ″.0301.
Sectional area, .000712 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0188	0.	
120	.....	.0243	.....	
140	.....	.0302	.....	
160	.....	.0360	.....	
180	.....	.0431	.....	
200	.....	.0499	.0019	
220	.....	.0572	.....	
240	.....	.0659	.....	
260	.....	.0763	.....	
280	.....	.0985	.0224	
300	421,350	.....	.....	Tensile strength.

Fractured 5½″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, .″024. Area, .000452 square inch.
Contraction of area, 36.5 per cent.

Wire submitted by Alfred Dolge, agent for Moritz Poehlmann, Nuremberg, Germany.

No. 6332.

No. 19 gauge.
Diameter, ″.0417.
Sectional area, .001366 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0104	.0001	
200	.....	.0250	.0011	
300	.....	.0426	.0059	
360	.....	.0542	.....	
380	.....	.0602	.....	
400	.....	.0657	.0098	
400	.....	.0679	.0119	
420	.....	.0720	.....	
440	.....	.0790	.....	
460	.....	.0898	.....	
472	345,530	.....	.....	Tensile strength.

Fractured 3½″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.030. Area, .000707 square inch.
Contraction of area, 48.2 per cent.

No. 6333.

No. 18 gauge.
Diameter, ″.0402.
Sectional area, .001269 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0104	.0004	
200	.....	.0268	.0015	
220	.....	.0306	.....	
240	.....	.0342	.....	
260	.....	.0379	.....	
280	.....	.0417	.....	
300	.....	.0467	.0041	
320	.....	.0510	.....	
340	.....	.0552	.....	
360	.....	.0605	.....	
380	.....	.0678	.....	
400	.....	.0747	.0145	
420	.....	.0819	.....	
436	343,580	.....	.....	Tensile strength.

Fractured at face of jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.028. Area, .000616 square inch.
Contraction of area, 51.5 per cent.

No. 6334.

No. 17 gauge.
Diameter, ″.0381.
Sectional area, .001140 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0106	.....	
200	.....	.0284	.....	
220	.....	.0318	.....	
240	.....	.0360	.....	
260	.....	.0404	.....	
280	.....	.0447	.....	
300	.....	.0491	.0020	
320	.....	.0536	.....	
340	.....	.0585	.....	
360	.....	.0639	.....	
380	.....	.0710	.....	
400	.....	.0780	.0108	
437	383,330	.....	.....	Tensile strength.

Fractured 4″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.028. Area, .000616 square inch.
Contraction of area, 46 per cent.

No. 6335.

No. 16 gauge.
Diameter, ″.0361.
Sectional area, .001024 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0124	.0002	
200	.....	.0323	.0007	
220	.....	.0364	.....	
240	.....	.0407	.....	
260	.....	.0452	.....	
280	.....	.0502	.....	
300	.....	.0551	.0027	
320	.....	.0609	.....	
340	.....	.0668	.....	
360	.....	.0730	.....	
380	.....	.0826	.0113	
418	408,200	.....	.....	Tensile strength.

Fractured 9¾″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.028. Area, .000616 square inch.
Contraction of area, 39.8 per cent.

No. 6336.

No. 15 gauge.
Diameter, ″.0342.
Sectional area, .000919 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0141	.0007	
200	.....	.0368	.0017	
220	.....	.0424	.....	
240	.....	.0479	.....	
260	.....	.0537	.....	
280	.....	.0605	.....	
300	.....	.0672	.0082	
320	.....	.0784	.....	
352	383,020	.....	.....	Tensile strength.

Fractured 2″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.023. Area, .000415 square inch.
Contraction of area, 54.8 per cent.

No. 6337.

No. 14 gauge.
Diameter, ″.0323.
Sectional area, .000819 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0148	.0002	
200	.....	.0419	.0023	
220	.....	.0482	.....	
240	.....	.0548	.....	
260	.....	.0612	.....	
280	.....	.0703	.....	
300	.....	.0822	.0152	
329	401,710	.....	.....	Tensile strength.

Fractured at the jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.023. Area, .000415 square inch.
Contraction of area, 49.3 per cent.

No. 6338.

No. 13 gauge.
Diameter, ″.0303.
Sectional area, .000721 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0169	.0004	
120	.....	.0225	.....	
140	.....	.0278	.....	
160	.....	.0335	.....	
180	.....	.0400	.....	
200	.....	.0460	.0016	
220	.....	.0522	.....	
240	.....	.0602	.....	
260	.....	.0690	.....	
280	.....	.0805	.0107	
314	435,510	.....	.....	Tensile strength.

Fractured 8½″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.024. Area, .000452 square inch.
Contraction of area, 37.3 per cent.

No. 6339.

No. 12 gauge.
Diameter, ″.0284.
Sectional area, .000633 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0202	0.	
120	.....	.0261	.....	
140	.....	.0329	.....	
160	.....	.0400	.....	
180	.....	.0472	.....	
200	.....	.0558	.0028	
220	.....	.0633	.....	
240	.....	.0760	.0087	
283	447,080	.....	.....	Tensile strength.

Fractured 2¼″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.022. Area, .000380 square inch.
Contraction of area, 40 per cent.

Wire submitted by Hermann Hillger, agent for Stahl und Drahtwerk Roeslau, Roeslau, Germany.

No. 6340.

No. 20 gauge.
Diameter, { Maximum, ″.0451. Minimum, ″.0444. Mean, ″.0448.
Sectional area, .001576 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0081	.0003	
200	.....	.0226	.0016	
220	.....	.0251	.....	
240	.....	.0282	.....	
260	.....	.0316	.....	
280	.....	.0349	.....	
300	.....	.0387	.0045	
320	.....	.0419	.....	
340	.....	.0452	.....	
360	.....	.0497	.....	
380	.....	.0539	.....	
400	.....	.0588	.0099	
420	.....	.0642	.....	
440	.....	.0706	.....	
460	.....	.0807	.....	
480	.....	.0971	.0335	
497	315,360	.....	.....	Tensile strength.

Fractured 3¾″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.034. Area, .000908 square inch.
Contraction of area, 42.4 per cent.

No. 6342.

No. 16 gauge.
Diameter, { Maximum, ″.0354. Minimum, .0353. Mean, .0353.
Sectional area, .000979 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0139	.0006	
120	.....	.0182	.....	
140	.....	.0228	.....	
160	.....	.0279	.....	
180	.....	.0324	.....	
200	.....	.0380	.0032	
220	.....	.0432	.....	
240	.....	.0484	.....	
260	.....	.0553	.....	
280	.....	.0620	.....	
300	.....	.0702	.0121	
340	.....	.09+	.....	
364	371,810	.....	.....	Tensile strength.

Fractured 2″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.028. Area, ″.000616 square inch.
Contraction of area, 37.1 per cent.

No. 6343.

No. 16 gauge.
Diameter, { Maximum, ″.0372. Maximum, ″.0364. Mean, ″.0368.
Sectional area, .001064 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0122	.0008	
200	.....	.0332	.0022	
220	.....	.0378	.....	
240	.....	.0430	.....	
260	.....	.0492	.....	
280	.....	.0551	.....	
300	.....	.0620	.0101	
320	.....	.0698	.....	
340	.....	.0839	.0215	
364	342,100	.....	.....	Tensile strength.

Fractured at face of jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.026. Area, .000531 square inch.
Contraction of area, 50.1 per cent.

No. 6341.

No. 15 gauge.
Diameter, { Maximum, ″.0344.
Minimum, ″.0338.
Mean, ″.0341.
Sectional area, .000913 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0154	.0010	
120	.....	.0196	.....	
140	.....	.0246	.....	
160	.....	.0296	.....	
180	.....	.0346	.....	
200	.....	.0408	.0025	
220	.....	.0457	.....	
240	.....	.0517	.....	
260	.....	.0597	.....	
280	.....	.0706	.0134	
320	350,490	.....	.....	Tensile strength.

Fractured 9½″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.023. Area, .000415 square inch.
Contraction of area, 54.5 per cent.

No. 6344.

No. 14 gauge.
Diameter, { Maximum, ″.0321.
Minimum, ″.0318.
Mean, ″.0320.
Sectional area, .000804 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
40	.....	0.	0.	Initial load.
100	.....	.0177	.0007	
120	.....	.0231	.....	
140	.....	.0296	.....	
160	.....	.0365	.....	
180	.....	.0436	.....	
200	.....	.0545	.0118	
220	.....	.0687	.....	
236	293,530	.....	.....	Tensile strength.

Fractured 8½″ from jaws. Appearance, fine silky. Cup-shaped ends.
Diameter at fracture, ″.025. Area, .000491 square inch.
Contraction of area, 38.9 per cent.

TENSILE TESTS OF MUSIC WIRE WITH EYES IN ONE END.

The eyeing was done by Messrs. O. J. Faxon & Co., Boston, Mass. At the end of the sample having the eye it was secured to the testing machine over a pin ".16 diameter. The opposite plain end of the wire was held between flat jaws of the testing machine.

WIRE SUBMITTED BY THE WASHBURN & MOEN MANUFACTURING COMPANY.

No. of test.	No. of gauge.	Load on wire when eye drew ".05.	Tensile strength.	Fractured.
		Pounds.	*Pounds.*	
6686	27	.....	498	Eye at first twist of loop.
6687	26	440	524	Do.
6688	25	410	709	Wire at inside end of twisted section.
6689	24	428	597	Do.
6690	23	.....	378	Do.
6691	22	350	499	Eye at first twist of loop.
6692	21	396	480	Wire at inside end of twisted section.
6693	20	226	326	Eye at first twist of loop.
6694	19	266	334	Do.
6695	18	234	371	Do.
6696	17	329	369	Wire at inside end of twisted section.
6697	16	200	325	Do.
6698	15	220	294	Do.
6699	14	244	288	Do.
6700	13	215	270	Do.
6701	12	166	226	Do.

WIRE SUBMITTED BY THE TRENTON IRON COMPANY.

6702	18	.....	199	Wire at inside end of twisted section.
6703	17	260	326	Wire ½" inside the twisted section. The wire in this vicinity evidently had been subjected to torsion and given several turns during or prior to eyeing.
6707	16	250	296	Wire at inside end of twisted section.
6708	15	202	202	Do.
6709	14	110	276	Do.
6710	13	186	248	Do.

WIRE SUBMITTED BY ALFRED DOLGE, AGENT FOR MORITZ POEHLMANN, NUREMBURG, GERMANY.

6711	19	250	314	Wire at inside end of twisted section.
6712	18	265	372	Do.
6713	17	256	334	Do.
6714	16	220	346	Do.
6715	15	266	298	Do.
6716	14	178	292	Eye at first twist of loop.
6717	13	156	276	Wire at inside end of twisted section.
6718	12	163	226	Eye at first twist of loop.

WIRE SUBMITTED BY HERMANN HILLGER, AGENT FOR STAHL UND DRAHT-WERK ROESLAU, ROESLAU, GERMANY.

No. of test.	No. of gauge.	Load on wire when eye drew ".05.	Tensile strength.	Fractured.
		Pounds.	*Pounds.*	
6719	About 20	288	401	Eye at first twist of loop.
6720	About 16	282	316	Do.
6721	About 16	214	258	Do.
6722	About 15	268	276	Do.
6723	About 14	142	181	Do.

The eyed samples of Roeslau wire were, owing to scarcity of material, the fractured ends of tensile specimens.

All other kinds of wires were from new samples which had not previously been tested.

Eyed samples, the eyes of which were on the several coils of wire when received from the makers of the wire.

No. of test.	Manufacturers.	No. of gauge.	Tensile strength.	Fractured.
			Pounds.	
6724	Washburn & Moen Manufacturing Company.	25	554	Wire at inside end of twisted wire.
6725	.....do	24	556	Do.
6726	.....do	23	461	Do.
6727	.....do	22	434	Do.
6728	.....do	21	392	Do.
6729	.....do	20	393	Eye at first twist of loop.
6730	.....do	19	362	Wire at inside end of twisted wire.
6731	.....do	18	328	Do.
6732	.....do	15	273	Do.
6733	.....do	14	264	Do.
6734	.....do	13	218	Do.
6735	.....do	12	204	Do.
6736	Trenton Iron Company	18	334	Do.
6737	.....do	17	362	Do.
6738	.....do	16	302	Do.
6739	.....do	15	283	Do.
6740	.....do	14	251	Do.

Tests of eyes made at the Watertown Arsenal.

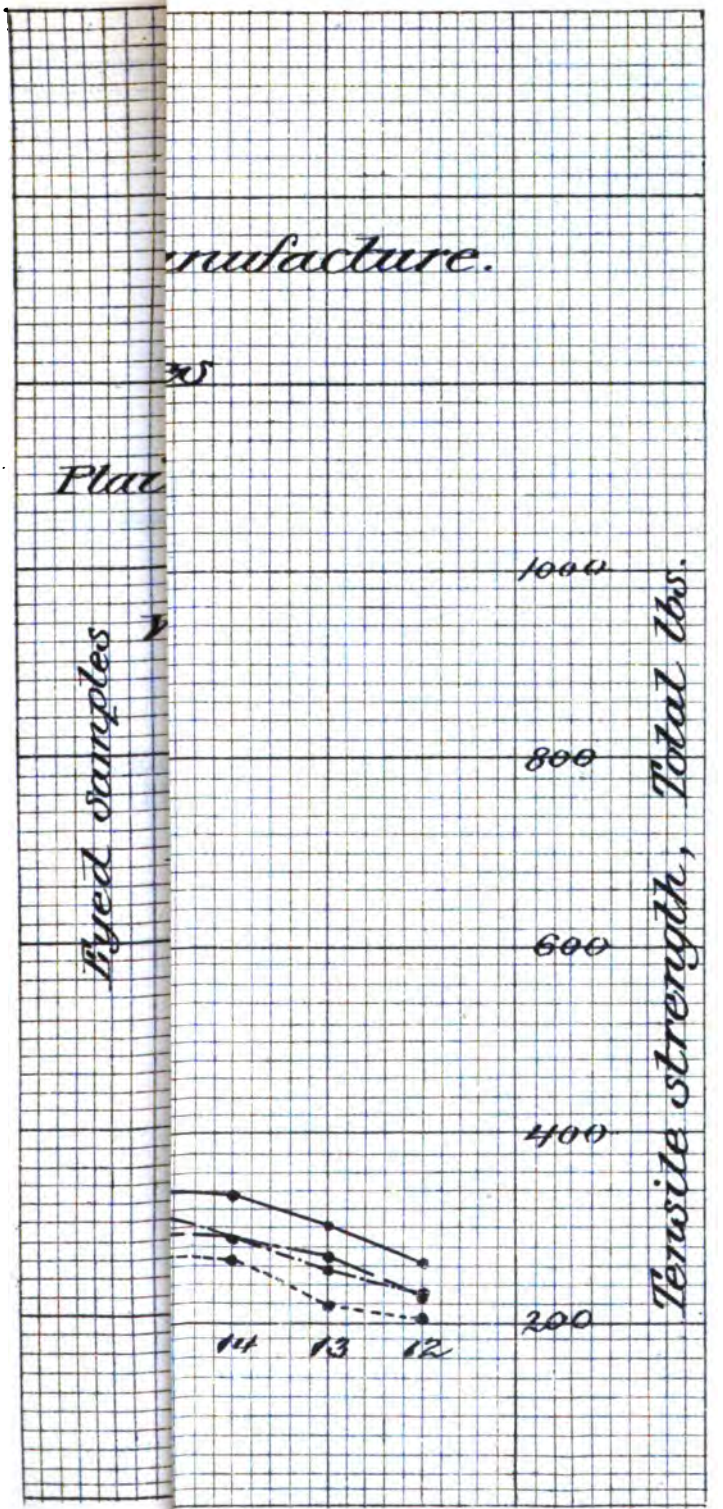
No. of test.	Manufacturers.	No. of gauge.	Tensile strength.	Remarks.
			Pounds.	
6741	Trenton Iron Company	18	389	
6742	do	18	390	
6743	do	17	358	
6744	do	17	372	
6745	do	16	326	
6746	do	16	334	
6747	do	15	306	
6748	do	15	298	
6749	do	14	293	
6750	do	14	297	
6751	do	13	252	
6752	do	13	257	
6753	Washburn & Moen Manufacturing Company.	27	924	
6754	do	27	907	
6755	do	27	904	One eye unwrapped at 805 pounds; new eye put in.
6756	do	26	874	
6757	do	26	860	
6758	do	25	702	
6759	do	25	728	
6760	do	24	672	
6761	do	24	659	
6762	do	23	589	
6763	do	23	627	
6764	do	22	558	
6765	do	22	549	
6766	do	21	486	
6767	do	21	496	
6768	do	21	499	
6769	do	20	457	
6770	do	20	445	
6771	do	19	448	
6772	do	19	424	
6773	do	18	432	Eye twisted 1½ twists per inch, a length of 6 inches.
6774	do	18	248	Eye twisted 2 twists per inch, a length of 1½ inches. Untwisted, wire not fractured.
6775	do	18	278	Do.
6776	do	18	414	Eye twisted 2 twists per inch, a length of 3 inches.
6777	do	18	421	Eye twisted 2½ twists per inch.
6778	do	18	398	Eye twisted 4 twists per inch.
6779	do	18	394	Do.
6780	do	18	369	Eye twisted 4½ twists per inch.
6781	do	18	360	Eye twisted 5 twists per inch.
6782	do	18	355	Eye twisted 5½ twists per inch.
6783	do	17	376	
6784	do	17	388	
6785	do	16	366	
6786	do	16	359	
6787	do	15	302	
6788	do	15	321	
6789	do	14	283	
6790	do	14	294	
6791	do	13	252	
6792	do	13	263	
6793	do	12	235	
6794	do	12	225	

Tensile Tests, over Wrest Pins.

Tensile tests of music wire secured at one end by means of three turns around a pin $\frac{5}{16}$ inch in diameter, the loose end being carried through an eye in the pin.

This method of fastening was intended to represent the end of a piano string at the wrest pin as commonly fastened.

No. of test.	Manufacturers.	No. of gauge.	Tensile strength.	Fractured.
			Pounds.	
6797	Trenton Iron Company	18	416	At first turn on pin.
6798	do	18	394	Do.
6799	do	17	364	Do.
6800	do	17	351	Do.
6801	do	16	343	Do.
6802	do	16	335	Do.
6803	do	15	319	Do.
6804	do	15	315	Do.
6805	do	14	285	Do.
6806	do	14	288	Do.
6807	do	13	272	Do.
6808	do	13	260	Do.
6809	Washburn & Moen Manfactur-ing Company.	27	948	Do.
6810	do	27	946	Do.
6811	do	26	873	Do.
6812	do	26	820	Do.
6813	do	25	704	Do.
6814	do	25	731	Do.
6815	do	24	621	Do.
6816	do	24	649	Do.
6817	do	23	576	Do.
6818	do	23	597	Do.
6819	do	22	572	Do.
6820	do	22	572	Do.
6821	do	21	466	Do.
6822	do	21	516	Do.
6823	do	20	464	Do.
6824	do	20	441	Do.
6825	do	19	429	Do.
6826	do	19	414	Do.
6827	do	18	419	Do.
6828	do	18	404	Do.
6829	do	17	364	Do.
6830	do	17	376	Do.
6831	do	16	344	Do.
6832	do	16	356	Do.
6833	do	15	308	Do.
6834	do	15	309	Do.
6835	do	14	301	Do.
6836	do	14	306	Do.
6837	do	13	279	Do.
6838	do	13	272	Do.
6839	do	12	239	Do.
6840	do	12	235	Do.

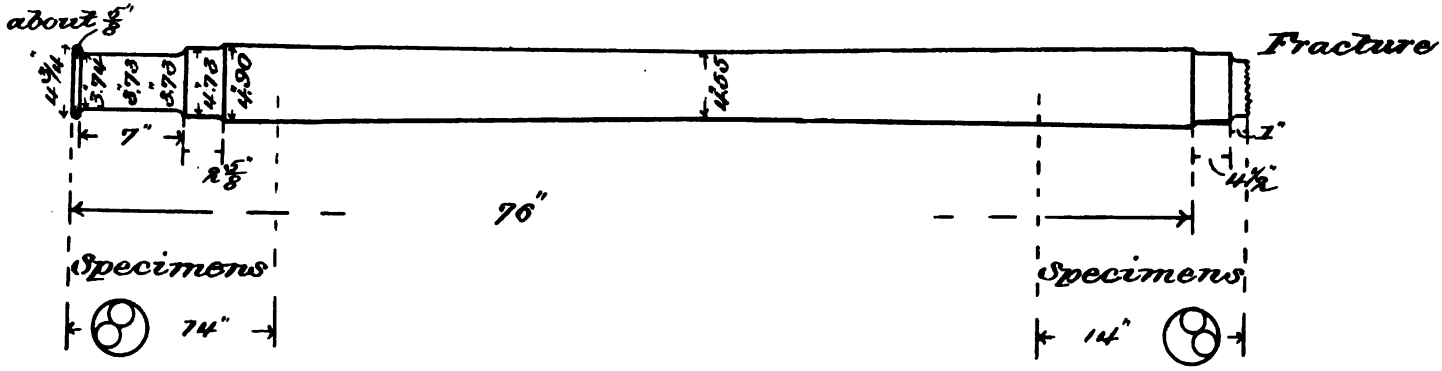

nufacture.
Plat
Fixed samples
1000
800
600
400
200
Tensile strength, Total lbs.
14
13
12

RAILROAD AXLES.

SPECIMENS FROM AXLES THAT WERE BROKEN WHILE IN SERVICE, AND FROM NEW OPEN-HEARTH STEEL AXLES.

Wrought iron Axle, which ran hot, and journal broke off under N.Y.C.R.R. Baggage Car #1900.

Marks on end of journal, "∧ ∧ 11192"



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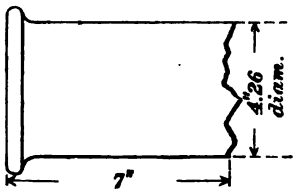
RAILROAD AXLES.

No. 5213.

Specimen from fractured journal which ran hot and broke off under a New York Central Railroad car.

Sketch of 

fractured journal.

Marks . .
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".
Specimen taken out parallel to the axis of the journal.

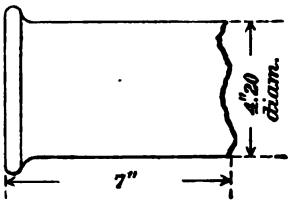
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0004	0.	
2,500	10,000	.0010	.....	
3,750	15,000	.0016	.....	
5,000	20,000	.0021	.0001	
5,250	21,000	.0022	.....	Elastic limit.
5,500	22,000	.0026	.....	
5,750	23,000	.0029	.....	
6,000	24,000	.0039	.....	
6,250	25,000	.0060	.0032	
6,500	26,000	.0095	.....	
6,750	27,000	.0109	.....	
7,000	28,000	.0148	.....	
7,250	29,000	.0185	.....	
7,500	30,000	.0262	.0230	
8,000	32,000	.04	.....	
8,500	34,000	.05	.....	
9,000	36,000	.08	.....	
9,500	38,000	.10	.....	
10,000	40,000	.13	.....	
10,500	42,000	.18	.....	
11,000	44,000	.24	.....	
11,500	46,000	.34	.....	
11,800	47,200	.53	.....	Tensile strength.
0	0	.79	.....	=26.3 per cent.

Elongation of inch sections, ".39*, ".24, ".16.
Diameter at fracture, ".44. Area, .1521 square inch.
Contraction of area, 39.2 per cent.
Fractured ".80 from the neck. Appearance, fibrous.

No. 5214.

Specimen from a fractured journal from an axle under a New York Central Railroad car.

The axle was put into service March 31, 1893, and ran less than one year. The surface of the journal and fractured end was blue-black in color.

Sketch of 

fractured journal.

Marks, 3, 31, 93 W.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 3".
Specimen taken out parallel to the axis of the journal.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0003	0.	
2,500	10,000	.0006	.....	
3,750	15,000	.0012	.....	
5,000	20,000	.0016	0.	Elastic limit.
5,250	21,000	.0022	.....	
5,500	22,000	.0030	.....	
5,750	23,000	.0045	.....	
6,000	24,000	.0059	.....	
6,250	25,000	.0083	.0055	
6,500	26,000	.0100	.....	
6,750	27,000	.0130	.....	
7,000	28,000	.0185	.....	
7,250	29,000	.0243	.....	
7,500	30,000	.0350	.0318	
8,000	32,000	.04	.....	
8,500	34,000	.07	.....	
9,000	36,000	.09	.....	
9,500	38,000	.11	.....	
10,000	40,000	.15	.....	
10,500	42,000	.20	.....	
11,000	44,000	.25	.....	
11,500	46,000	.37	.....	
11,726	46,904	.46	.....	Tensile strength.
0	0	.53	.....	= 17.7 per cent.

Elongation of inch sections, ".27*, ".13, ".13.
Diameter at fracture, ".48. Area, .181 square inch.
Contraction of area, 27.6 per cent.
Fractured ".50 from neck. Appearance, fibrous.

Four specimens, two from each end, from an axle which ran hot and the journal broke off under New York Central Railroad baggage car No. 1900.

The journal was worn down about $\frac{1}{16}$ inch smaller than the original size.

No. 5215.

Specimen from fractured end.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.
Specimens taken out parallel to the axis of the axle.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0014	0.	
10,000	10,000	.0033		
15,000	15,000	.0052		
20,000	20,000	.0071	.0002	Elastic limit.
21,000	21,000	.0099		
22,000	22,000	.0190		
23,000	23,000	.0300		
24,000	24,000	.0470		
25,000	25,000	.0693	.0601	
26,000	26,000	.10		
27,000	27,000	.12		
28,000	28,000	.15		
29,000	29,000	.18		
30,000	30,000	.20		
32,000	32,000	.28		
34,000	34,000	.36		
36,000	36,000	.45		
38,000	38,000	.59		
40,000	40,000	.76		
42,000	42,000	.99		
44,000	44,000	1.50		
44,680	44,680	1.96		Tensile strength.
0	0	2.04		=20.4 per cent.

Elongation of inch sections: ″.18, ″.19, ″.20, ″.28, ″.35*, ″.22, ″.18, ″.14, ″.15, ″.15.
Diameter at fracture, ″.94. Area, .694 square inch.
Contraction of area, 30.6 per cent.
Fractured 5″.2 from neck. Appearance, fibrous.

No. 5216.

Specimen from fractured end.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0012	0.	
10,000	10,000	.0031	.....	
15,000	15,000	.0051	.....	
20,000	20,000	.0070	0.	
21,000	21,000	.0077	.....	Elastic limit
22,000	22,000	.0090	.....	
23,000	23,000	.0106	.....	
24,000	24,000	.0138	.....	
25,000	25,000	.0210	.0120	
26,000	26,000	.0290	.....	
27,000	27,000	.0308	.....	
28,000	28,000	.0460	.....	
29,000	29,008	.0650	.....	
30,000	30,000	.0910	.0800	
32,000	32,000	.16	.....	
34,000	34,000	.22	.....	
36,000	36,000	.30	.....	
38,000	38,000	.38	.....	
40,000	40,000	.48	.....	
42,000	42,000	.61	.....	
44,000	44,000	.80	.....	
46,000	46,000	1.09	.....	
47,000	47,000	1.42	.....	
47,250	47,250	1.58	.....	Tensile strength.
0	0	1.70	.....	=17.0 per cent.

Elongation of inch sections, ″.12, ″.12, ″.16, ″.19, ″.21, ″.34*, ″.16, ″.13, ″.15, ″.12.

Diameter at fracture, ″.96. Area, .724 square inch.

Contraction of area, 27.6.

Fractured at middle of stem. Appearance, fibrous. Opened cracks in stem in vicinity of fracture.

No. 5217.

Specimen from end of axle not fractured; includes the metal in the journal.

Diameter, 1″.129.

Sectional area, 1 square inch.

Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0013	0.	
10,000	10,000	.0031	.....	
15,000	15,000	.0050	.....	
20,000	20,000	.0070	.0001	
21,000	21,000	.0072	.....	Elastic limit.
22,000	22,000	.0079	.....	
23,000	23,000	.0140	.....	
24,000	24,000	.0240	.....	
25,000	25,000	.0400	.0311	
26,000	26,000	.0580	.....	
27,000	27,000	.0750	.....	
28,000	28,000	.0990	.....	
29,000	29,000	.1230	.....	
30,000	30,000	.1490	.1370	
32,000	32,000	.22	.....	
34,000	34,000	.30	.....	
36,000	36,000	.37	.....	
38,000	38,000	.48	.....	
40,000	40,000	.60	.....	
42,000	42,000	.78	.....	
44,000	44,000	1.01	.....	
45,700	45,700	.....	.....	Tensile strength.
0	0	1.37	.....	=13.7 per cent.

Elongation of inch sections, ″.12, ″.18, ″.19*, ″.13, ″.15, ″.13, ″.12, ″.11, ″.12, ″.12.

Diameter at fracture, 1″.02. Area, .817 square inch.

Contraction of area, 18.3 per cent.

Fractured 2″.65 from neck. Appearance, granular, 65 per cent; fibrous, 35 per cent; seamy.

No. 5218.

Specimen from end of axle not fractured.
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0016	0.	
10,000	10,000	.0035	.....	
15,000	15,000	.0053	.....	
20,000	20,000	.0074	.0007	Elastic limit.
21,000	21,000	.0089	.....	
22,000	22,000	.0102	.....	
23,000	23,000	.0122	.....	
24,000	24,000	.0190	.....	
25,000	25,000	.0318	.0221	
26,000	26,000	.0430	.....	
27,000	27,000	.0580	.....	
28,000	28,000	.0790	.....	
29,000	29,000	.1040	.....	
30,000	30,000	.1290	.1109	
32,000	32,000	.20	.....	
34,000	34,000	.28	.....	
36,000	36,000	.36	.....	
38,000	38,000	.46	.....	
40,000	40,000	.58	.....	
42,000	42,000	.77	.....	
44,000	44,000	1.00	.....	
45,690	45,690	1.48	.....	Tensile strength.
0	0	1.56	.....	= 15.6 per cent.

Elongation of inch sections, ″.13, ″.14, ″.13, ″.13, ″.21, ″.31*, ″.13, ″.12, ″.12, ″.14.
Diameter at fracture, ″.94. Area, .694 square inch.
Contraction of area, 30.6 per cent.
Fractured near middle of stem. Appearance, fibrous, seamy.

No. 5219.

Specimen cut from a new open-hearth steel axle.
Marks, . . .
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0013	0.	
10,000	10,000	.0030	.....	
15,000	15,000	.0049	.....	
20,000	20,000	.0066	.....	
25,000	25,000	.0083	.....	
30,000	30,000	.0111	.0011	Elastic limit.
31,000	31,000	.0135	.....	
32,000	32,000	.0220	.....	
33,000	33,000	.0530	.....	
34,000	34,000	.0610	.....	
35,000	35,000	.0700	.0560	
36,000	36,000	.0770	.....	
37,000	37,000	.0865	.....	
38,000	38,000	.0960	.....	
39,000	39,000	.1056	.....	
40,000	40,000	.1172	.1010	
42,000	42,000	.15	.....	
44,000	44,000	.17	.....	
46,000	46,000	.20	.....	
48,000	48,000	.23	.....	
50,000	50,000	.25	.....	
52,000	52,000	.29	.....	
54,000	54,000	.32	.....	
56,000	56,000	.37	.....	
58,000	58,000	.40	.....	
60,000	60,000	.46	.....	
62,000	62,000	.52	.....	
64,000	64,000	.59	.....	
66,000	66,000	.69	.....	
68,000	68,000	.82	.....	
70,000	70,000	1.00	.....	
72,000	72,000	1.27	.....	
73,090	73,090	1.76	.....	Tensile strength.
0	0	2.28	.....	= 22.8 per cent.

Elongation of inch sections, ″.13, ″.16, ″.16, ″.19, ″.19, ″.19, ″.21, ″.49*, ″.37, ″.19.
Diameter at fracture, ″.82. Area, .528 square inch.
Contraction of area, 47.2 per cent.
Fractured 2″.8 from neck. Appearance, silky.

No. 5220.

Specimen cut from a new open-hearth steel axle.
Marks, ...
Diameter, 1″.129.
Sectional area, 1 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	1,000	0.	0.	Initial load.
5,000	5,000	.0012	0.	
10,000	10,000	.0031	.....	
15,000	15,000	.0051	.....	
20,000	20,000	.0069	.....	
25,000	25,000	.0084	.....	
30,000	30,000	.0109	.0006	
31,000	31,000	.0115	.....	
32,000	32,000	.0122	.....	Elastic limit.
33,000	33,000	.0213	.....	
34,000	34,000	.0420	.....	
35,000	35,000	.0542	.0411	
36,000	36,000	.0620	.....	
37,000	37,000	.0690	.....	
38,000	38,000	.0770	.....	
39,000	39,000	.0850	.....	
40,000	40,000	.0970	.0808	
42,000	42,000	.12	.....	
44,000	44,000	.15	.....	
46,000	46,000	.17	.....	
48,000	48,000	.19	.....	
50,000	50,000	.21	.....	
52,000	52,000	.24	.....	
54,000	54,000	.27	.....	
56,000	56,000	.30	.....	
58,000	58,000	.32	.....	
60,000	60,000	.37	.....	
62,000	62,000	.42	.....	
64,000	64,000	.48	.....	
66,000	66,000	.53	.....	
68,000	68,000	.61	.....	
70,000	70,000	.72	.....	
72,000	72,000	.83	.....	
74,000	74,000	1.00	.....	
76,000	76,000	1.37	.....	
76,240	76,240	1.60	.....	Tensile strength.
0	0	1.90	.....	= 19.0 per cent.

Elongation of inch sections, ″.15, ″.16, ″.19, ″.27*, ″.30*, ″.18, ″.18, ″.18, ″.16, ″.13.

Diameter at fracture, ″.96. Area, .724 square inch.

Contraction of area, 27.6 per cent.

Fractured 4″.95 from neck. Appearance, granular, 85 per cent; silky, 15 per cent. Opened a series of short transverse cracks along surface of stem.

RAILROAD TRACK EXPERIMENTS.

RAILROAD TRACK EXPERIMENTS.
Photograph of leveling instrument for measuring the depression of the track.

RAILROAD TRACK EXPERIMENTS.

These experiments were made during the month of October, 1893, on the track of the Chicago, Burlington and Quincy Railroad at Hawthorne, Ill., with the cooperation and assistance of Mr. F. A. Delano, superintendent freight terminals of that road.

The experiments consisted of measuring the depression of the rails under the weights of different classes of locomotives, and the fiber stresses developed in the base of the rail.

Two weights of rails were experimented upon; a 66-pound section and a 75-pound section.

The rails rested upon oak ties supported by gravel ballast in some of the experiments, in others upon cinder ballast.

The track selected was in good condition, and the spikes redriven before the work began.

For the purpose of observing the depression of the rails bench marks were established on a row of stakes driven alongside the rail 31 inches distant from it. A beam carrying a micrometer and an astronomical level bubble was used in observing the depression of the rail; first measuring the height, using a point on the outer flange, when the rail was unloaded, and repeating the observation when the locomotive was in different positions with reference to this point, making the observations when the observed point was directly under each wheel, and when between them midway.

This constituted one class of experiments.

In another class a preliminary leveling was made of the entire rail and parts of the adjacent ones; then the locomotive was run onto the rail and while in one position the leveling was repeated, thus showing the depression of the entire rail and not the movement of one point, as in the first described experiments.

The comparative rigidity of the track under different weights of locomotives and different wheel bases and pressures on the wheels is shown in the results, the behavior of the two weights of rails and the relative supporting power of gravel and cinder ballast shown.

In one case a tie was removed and the behavior of the rail observed under these conditions.

It was found that the roadbed in the vicinity of the locomotive was sensibly depressed and that the bench marks were within the influence of that depression.

It was possible to detect a depression of the roadbed as far as 91 inches from the locomotive at the side of the track.

A correction for the depression of the bench marks was obtained by means of a cantilever supported 10 feet from the track, and the total depression of points on the rails was also determined with reference to the cantilevers in some of the experiments instead of using stakes.

The fiber stresses were determined in the base of the rail by measuring the elongation or compression of the metal on a gauged length of

5 inches established on the top surface of the outer flange, observing the strains when the wheels were directly over or when spanning the gauged length.

The observed strains are recorded on the diagrams, and the computed stresses per square inch based on the observed strains, assuming a modulus of elasticity of 30,000,000 pounds per square inch and that the fibers in the base were strained proportionally to their distance from the neutral axis of the rail, the computed stresses referring to the outside fibers most remote from the neutral axis.

It will be observed that the strains and the computed stresses refer to a gauged length of 5 inches, and consequently the maximum stresses may be somewhat greater than those shown, considering the maximum bending moment to be directly under the points of application of the load.

The results are graphically shown on the series of twelve diagrams following.

Advance wave determinations were made on the 66-pound rail on cinder ballast with engine No. 526 Class H, at station No. 10, under conditions shown on diagram No. 9.

With the locomotive slowly approaching, an upward movement of the rail began when the leading truck wheel reached station No. 1½. The wave increased while the locomotive continued to advance, and reached a maximum of ″.0037 when the truck wheel was over station No. 5½. Then followed a sudden depression, and the height of the rail was reduced to the normal level when the truck wheel was over station No. 6.

The trial was repeated, with the result of showing the first effect to be when the truck wheel was over station No. 1½ as before, maximum height, ″.0034, when the truck wheel was over station No. 6, and reduced to the normal height at station No. 6½.

The distance from station No. 10, the place of observation, to the locomotive when the upward movement of the rail began was 15 feet in each trial.

When the crest of the wave was reached the locomotive was 9 feet and 8 feet on the first and second trials, respectively, away from the station, and when the rail was reduced to its normal height the locomotive was 8 and 7 feet, respectively, distant from the station of observation.

The position of the locomotive when the upward motion of the wave first reached the station could be identified with considerable precision, but owing to an appreciable interval of time being necessary for the level bubble of the measuring instrument to stop and reverse the direction of its movement, the position of the crest of the wave, as well as the time when the height of the rail was returned to its normal level, could not be so well defined.

The wave length was probably somewhat less than the observations showed.

The abruptness with which the direction of the wave motion was changed and the rail returned to its normal level, after which of course it was depressed below the normal, was a very striking feature in the observations.

Drawings show the dimensions of the two rails here represented, one a 66-pound section, the other a 75-pound section.

Diagrams Nos. 1 to 5 inclusive show experiments made on the main line of the railroad, track No. 1, the north rail near the station at Hawthorne.

RAILROAD TRACK EXPERIMENTS.

Photograph of micrometer for determining the fiber stresses in the rail.

The first three diagrams show the depression of the rail under locomotives of Class H, as designated on that road.

The engines weighed 110,000 pounds and 125,000 pounds each. The distribution of the weights is shown on the diagrams. The total weights are given, hence one-half of these weights belongs to each side of the locomotive.

On diagram No. 1 are shown the depressions of the rail at a point midway ties Nos. 18 and 19, or at a distance of 26 inches from the end of the rail. All the observations refer to this one point.

The engine was run ahead and stopped at intervals while the observations were being made, the depression being measured when each wheel successively reached a position directly over the station of observation, measurements also being taken when the station was midway adjacent wheels.

The observed depressions were referred to a bench mark, a stake driven in the roadbed located on the side of the track, 31 inches from the rail, and these measurements are corrected and shown by a line below the shaded part of the diagram, which corrects the observed readings for the depression of the bench mark, owing to its proximity to the weight of the locomotive.

Diagram No. 2 shows the depressions of the rail under the weight of an engine of the same class, but 15,000 pounds heavier than that shown on diagram No. 1.

The measurements refer to station No. 15½. No correction is necessary, as the bench mark was on a cantilever supported at points beyond the zone of sensible influence of the locomotive.

Diagram No. 3 shows the depression of one rail its entire length and the ends of contiguous rails, the locomotive occupying one position as thereon shown with reference to the rail and ties.

On diagram No. 4 are shown the fiber stresses as measured on the base of the rail at station No. 14½, midway ties Nos. 14 and 15.

The metal in the base of the rail was in a state of tension as the wheels were successively brought over the gauged length, and when the gauged length was between wheels the metal was either in a neutral condition without measurable strain or else under a state of compression.

Diagram No. 5 shows the curve of depression under another type of locomotive.

This engine had no leading truck nor tender, but had a two-wheeled trailing truck.

In the position it occupied during the test the greatest depression of the rail occurred under the forward drivers, the rail presenting a sharp acclivity before the engine, and beyond the joint the contiguous rail rose slightly above its normal level.

Diagrams Nos. 6 and 7 refer to a 75-pound section in the main line, track No. 4.

Both diagrams show the depression of the rail, the observations being made at stations Nos. 6½ and 17½, respectively.

The differences in the curves of depression of the rail under these two types of locomotives are clearly shown, although the change in position of the station of observation with reference to the joint may have modified the results somewhat.

Diagrams Nos. 8 to 11, inclusive, refer to observations made on a 66-pound rail in side track in Hawthorne yard.

This track was laid on cinder ballast about 8 inches deep.

Nos. 8 and 9 show the depression of the track under locomotives of Class H. The more yielding character of the cinder ballast over the gravel of the preceding test is clearly shown.

Locomotive No. 480, diagram No. 8, had a 56-inch boiler, and the weight of the engine was 110,000 pounds, whereas locomotive No. 526, on diagram No. 9, had a 60-inch boiler, and the weight of its engine was 125,000 pounds.

The test illustrated on diagram No. 9 was made with a tie removed, and from this cause and the somewhat heavier engine a greater depression of the rail was observed in comparison with the behavior of the track as illustrated on diagram No. 8.

The tie selected for removal was where the spacing was rather closer than usual, excepting joint ties, the distance from center to center of ties Nos. 9 and 11, adjacent ties in this test, being only 33 inches; hence this example is probably not an exaggerated instance of such a space as might occur in practice.

Diagrams Nos. 10 and 11 show the fiber stresses observed at stations Nos. 16½ and 10, both series of observations being made with the same locomotive.

The removal of tie No. 10 raised the fiber stress from 13,810 pounds per square inch to 16,430 pounds per square inch, in making a direct comparison between the two stations.

In the examples before us the fiber stresses due to the driving wheels and the tender wheels are approximately proportional to the load. The leading truck wheels, however, give proportionally a higher average fiber stress than the other wheels.

The relative greater effect of the leading truck wheels over the drivers appeared also in some earlier tests, reported in Tests of Metals for the year 1889.

With conditions so variable it is difficult to arrive at refined conclusions from the data furnished by so few tests, but the indications make it appear disadvantageous to allow an abrupt termination of the load on the rail.

It is expected that additional tests will be made for the purpose of showing the relative severity of a short wheel base where drivers are used alone, and with leading trucks and tenders to the rear of the engine.

The disposition of the weights on the wheel base may be found, in confirmation of the present indications, to exert a very sensible influence on the maximum fiber stresses, as well as the gross load on the rail, and exert a modifying influence on the locomotive designs.

Diagram No. 12 shows the results of observations made to determine the correction necessary to compensate for the depression of the bench marks themselves which were used while measuring the depression of the rails.

For this purpose a cantilever was arranged alongside of the track, supported at its nearer point 10 feet from the rail, and comparisons made between the height of the cantilever and stakes at the side of and 31 inches from the track; the stakes representing the bench marks used in the earlier experiments.

On cinder ballast that part of the roadbed in which the stakes were driven was depressed a maximum of ″.049, and on gravel ballast the maximum was ″.036.

Wooden stakes and iron bolts were driven different depths into the roadbed with similar results; in fact, the few observations which were

made showed the longer stakes to have been quite as much depressed as the shorter ones which did not penetrate the cinder ballast.

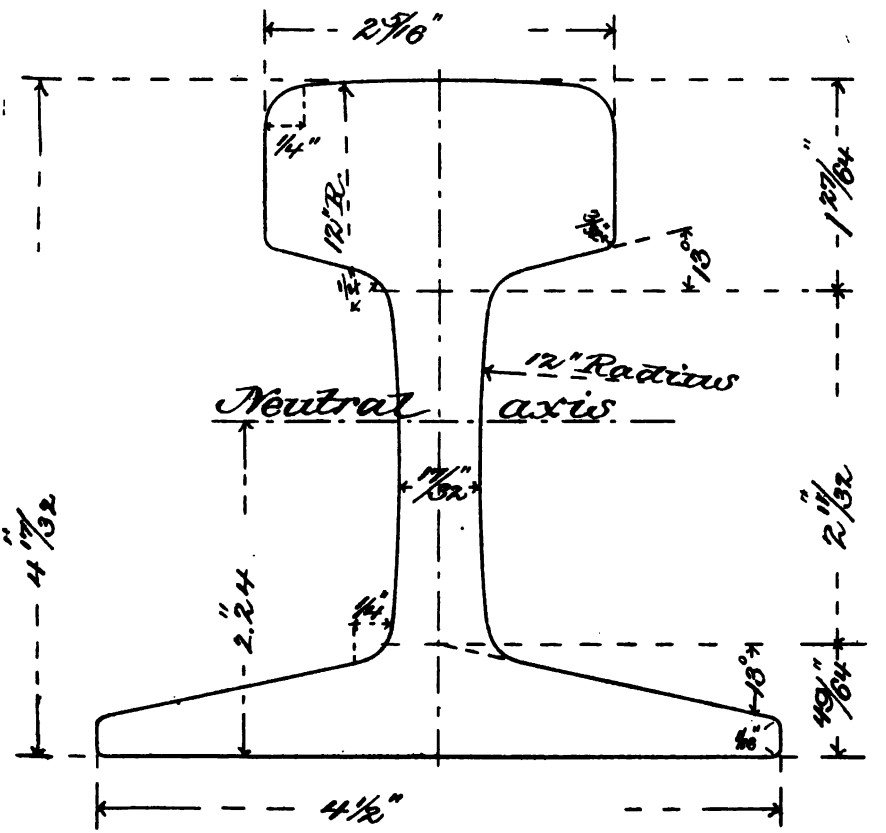
Following out the depression of the roadbed in a lateral direction, on cinder ballast, when the middle driver of the engine was abreast the place of observation, there was a measurable depression at a distance of 91 inches from the rail.

The recovery in the depression of the roadbed was not complete immediately upon the removal of the engine from that vicinity.

The principal part of the recovery at once took place; the remaining portion of the depression, however, was very sluggish in returning. The length of time required to effect complete resilience was not determined. One observation, however, made nine minutes after the load was removed from the vicinity, showed the resilience then incomplete.

Railroad Track Experiments.

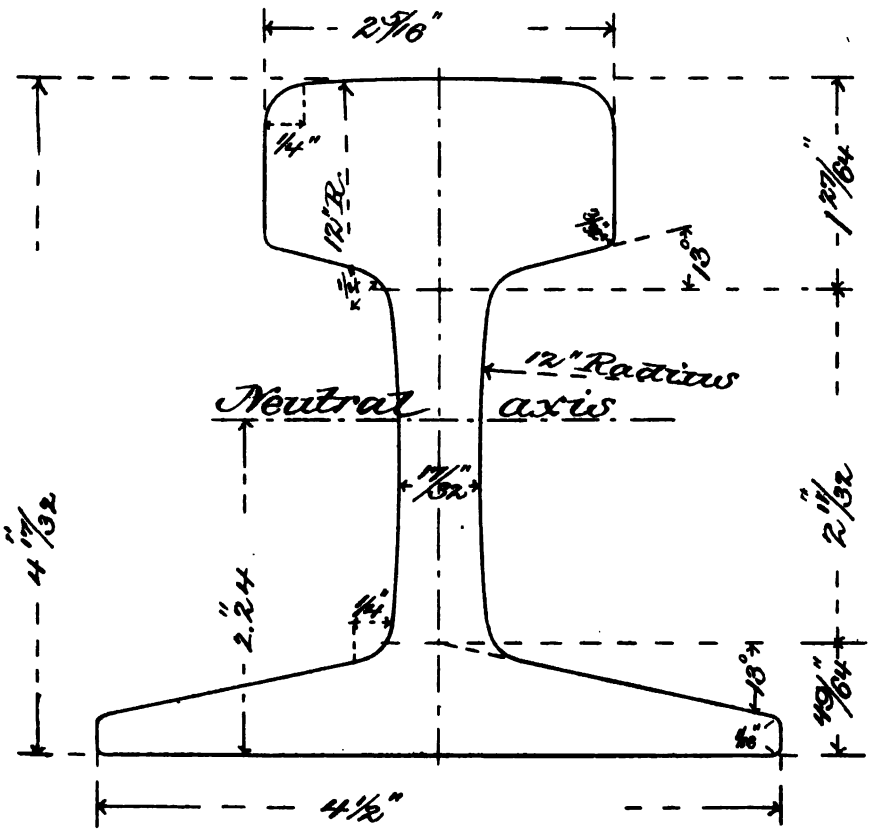
66 lbs section



Moment of Inertia 19.127

Railroad Track Experiments.

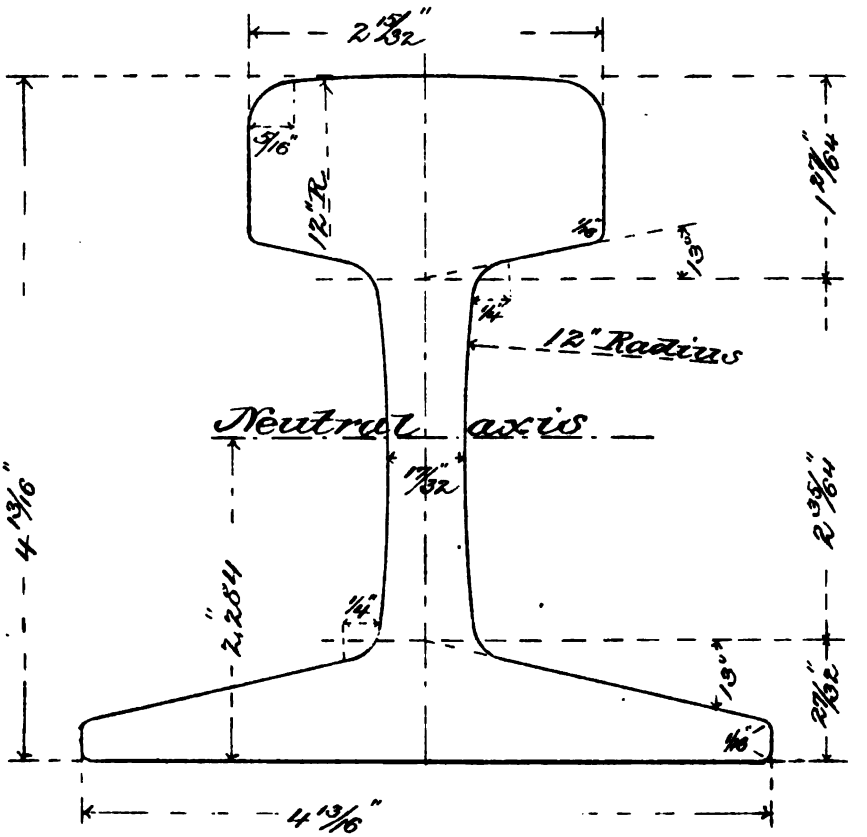
66 lbs section



Moment of Inertia 19.127

Railroad Track Experiments.

75 lbs section



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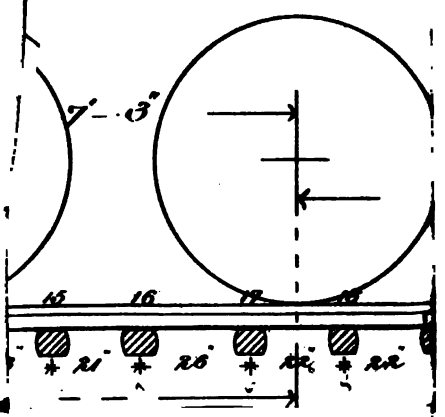

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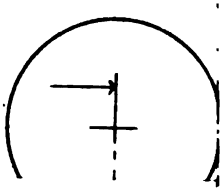

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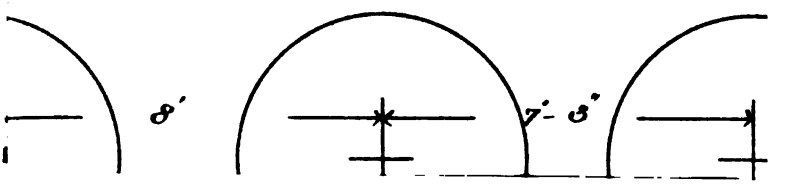

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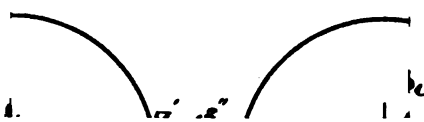

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Hawthorne Ill.,

Class H.

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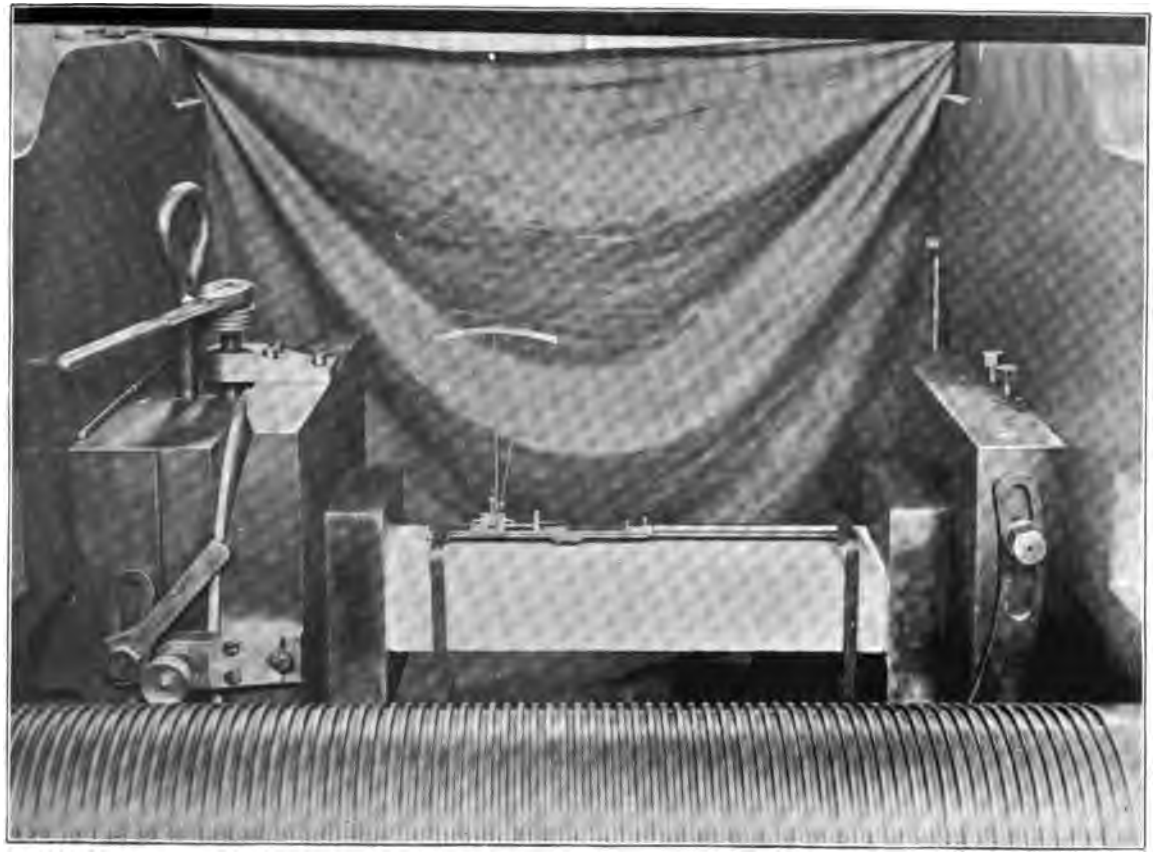
BUILDING MATERIAL.

NATURAL STONES AND BRICKS.

COMPRESSION TESTS, COMPRESSIVE ELASTIC PROPERTIES,
TRANSVERSE TESTS, SHEARING TESTS,

AND

DIAGRAMS OF CURVES OF EXPANSION.



THE ELASTIC PROPERTIES OF STONES.

Photograph showing micrometer in position for determining the compressibility of the material.

BUILDING MATERIAL, STONES AND BRICKS.

NATURAL STONES.

GENERAL DESCRIPTION.

Kind of stone.	Color.	Quarry.	State.	Town or county.	Age since quarried.	Contributor.
					Months.	
Granite	Pink		Connecticut	Branford		Charles River Stone Company, Boston, Mass.
Granite	Pinkish white		Massachusetts	Milford		Do.
Granite	Gray		New Hampshire	Troy		Do.
Granite	Pink		Massachusetts	Milford	1	Milford Pink Granite Company, Boston, Mass.
Granite	Gray	Pigeon Hill	do	Rockport	1	Pigeon Hill Granite Company, Rockport, Mass.
Marble	White, clouded with gray.	Creole	Georgia	Tate		Georgia Marble Company, Tate, Ga.
Marble	do	Cherokee	do	do		Do.
Marble	Pink	Etowah	do	do		Do.
Marble	White	Kennesaw	do	do		Do.
Marble	do		Massachusetts	Lee		
Marble	do		Georgia	Marble Hill		Charles River Stone Company, Boston, Mass.
Marble	White, crystalline		New York	Tuckahoe		Do.
Limestone	Drab		Kentucky	Mt. Vernon	1	Dr. A. G. Lovell.
Limestone, Oolitic	Buff		Indiana	Bedford		
Bluestone	Blue	North River	New York			
Slate	do		Maine	Monson		
Sandstone	Bluish gray	Cooper	Oregon	Douglas	3	Jos. G. Kelley, C. E., Roseburg, Oreg.
Sandstone	Red	Maynard	Massachusetts	East Longmeadow		Charles River Stone Company, Boston, Mass.
Sandstone	do	Kibbe	do	do		Do.
Sandstone	Brown	Worcester	do	do		Do.
Sandstone, Potomac	Red		Maryland			
Sandstone	Blue	Olympia	Oregon	Olympia		George E. Huggins.

BUILDING MATERIAL.

The results herewith submitted form a part of a general series of tests on the building material of the country, which is intended eventually to include representative material from each State and Territory.

The scope of the tests with reference to stones, as outlined in an earlier report (see Report of Tests, 1890), will include the usual compression tests of the material, also transverse and shearing tests, and, furthermore, researches into the elastic properties under the influence of compression loads, exposure to different degrees of heat in a dry atmosphere and in the presence of moisture.

The effect of chemical treatment will also be observed.

In the results which follow may be seen how different are the characteristics of the several building stones which have been examined, and, as the investigation proceeds, the significance of these features may become better known, resulting, it is hoped, in reaching such a state of knowledge as will definitely indicate the peculiar properties of each class of stones and show what features contribute toward durability and what are unfavorable ones.

The investigation therefore has two principal objects to accomplish: First, to ascertain the strength of the material and the accompanying physical phenomena, and, second, to acquire, so far as may be developed, a knowledge of the durability of the material and what features distinguish the better class of stones over those which experience has shown do not well resist deteriorating influences.

The results first presented are compression tests made on cubes measuring 4 inches on each side.

The samples were dressed, hammered, or ground on all faces. Before testing, however, the compressed surfaces were faced with a thin coating of plaster of paris to improve the surfaces by securing a better distribution of the compression loads over the material.

In the details of the tests is found a column in which is recorded the load under which the specimen developed its first crack.

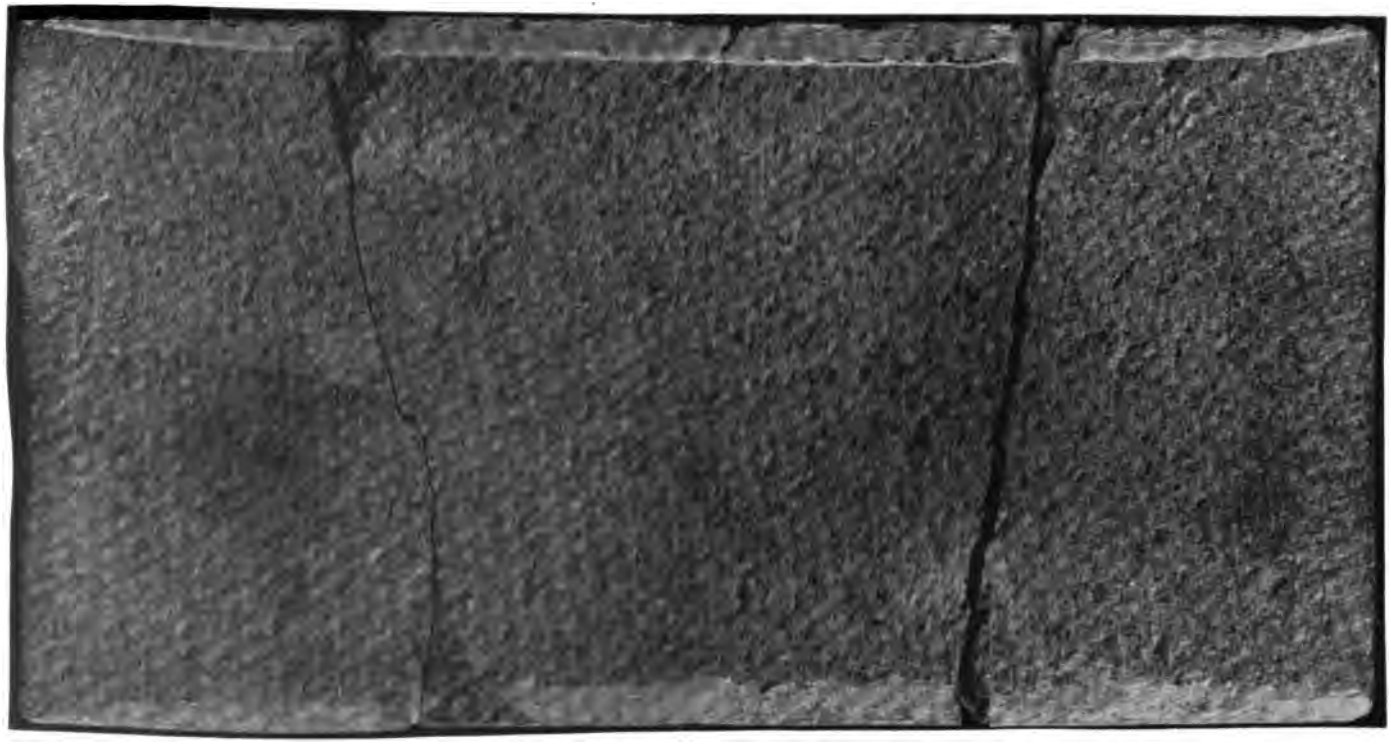
The time when this first crack appeared differed considerably with different stones. With some stones cracks began to develop at one-fourth of the ultimate resistance, while with others there was no warning of impending rupture. Simultaneously with the first crack came complete rupture.

Generally stones which commence to develop cracks early are characterized by their frequent recurrence as the loads are increased and approach the ultimate strength, when an explosive failure occurs in the case of hard rocks, a more gradual fracture taking place with the softer stones.

The prisms 4″ by 6″ by 24″ were examined for elastic properties under compression loads applied parallel to the direction of the long sides; these examples were also used for the coefficient of expansion determinations and the effects of moisture, after which they are to be broken by transverse loads.

The compressibility of the stones was measured by means of the micrometer shown on the accompanying photograph, which covered a gauged length of 20 inches on the specimen.

The ends of these specimens were also faced with plaster of paris and a careful adjustment made of the specimen in the testing machine to secure a uniform distribution of the loads over the compressed surfaces.



THE SHEARING STRENGTH OF STONES.

Photograph of fractured specimen of Troy, N. H., granite.

Micrometer observations were made under different loads, beginning with an initial load of 100 pounds per square inch.

Permanent sets were determined at intervals, and the behavior of the stones noted while under reduced and repeated stresses.

Stones have a variable modulus of elasticity, the rigidity generally increasing with the stresses.

Two values of the modulus are computed and entered in the tabulation of the results. The first value is taken between two lower loads, the second between two higher loads, not, however, in the latter case very closely approaching the compressive strength of the material.

These observations, as well as those relating to the coefficient of expansion by heat and the effects of moisture, were made on the specimens intended for subsequent test with transverse loads.

On diagram No. 1 is graphically shown the behavior of different classes of stones which cover the range of elastic properties thus far observed.

The most rigid stone under compression loads was a sample of marble (dolomite) from Tuckahoe, N. Y. Stones of intermediate rigidity were several granites and a sample of North River bluestone, while the softest grades of material examined were represented by the sandstones.

Numerically the Tuckahoe marble was about seven times as rigid as the Kibbe sandstone—that is, to cause an equal amount of compression the Tuckahoe marble would require seven times the load placed on the Kibbe standstone.

On diagram No. 2 are curves of compressions of a group of granites, diagram No. 3 showing similar curves of marble and limestones, and diagram No. 4 those of sandstones.

Diagram No. 5 shows different classes of stones. The curves of compression under ascending stresses when these loads were first applied are shown, and also the permanent sets which were then developed. Additional curves show the behavior of the stones under subsequent loads both with ascending and descending stresses.

Stones commonly develop permanent sets under early loads, which gradually increase in amount as higher loads are applied.

There is a difference between the curve under ascending and descending stresses, and the divergence of these curves from the same path appears to depend upon the maximum stress applied in each case.

The higher the stress the wider apart are the two curves.

The area between the two curves of ascending and descending stresses represents, it is supposed, the mechanical work absorbed by the internal frictional resistance of the material. Similar curves are shown by overstrained iron and steel bars, but from this condition there is a tendency to recover.

No cases of recovery of stone samples have yet been met, although observations have not extended over so wide an interval of time with this material as in the case of experiments with iron and steel bars.

Following the measurements of the longitudinal compressibility of the stones, the micrometer was placed on the samples transversely and the lateral expansion determined. The ratio of lateral expansion to longitudinal extension or compression in the case of steel has been found to be nearly $\frac{1}{3.3}$.

Some of these stones have a higher ratio than the steel, while on the other hand the ratio is much smaller with some stones, being only $\frac{1}{11}$ for the Cooper sandstone.

The following are the computed values of this ratio for the stones thus far tested:

Branford granite	$\frac{1}{4}$
Milford granite	$\frac{1}{5.8}$
Troy granite	$\frac{1}{5.1}$
Creole marble	$\frac{1}{3.9}$
Cherokee marble	$\frac{1}{3.7}$
Etowah marble	$\frac{1}{3.6}$
Kennesaw marble	$\frac{1}{3.9}$
Southern marble, Marble Hill	$\frac{1}{3.4}$
Tuckahoe marble	$\frac{1}{4.5}$
Mount Vernon limestone	$\frac{1}{4}$
Cooper sandstone	$\frac{1}{11}$
Maynard sandstone	$\frac{1}{5}$
Kibbe sandstone	$\frac{1}{3.2}$
Worcester sandstone	$\frac{1}{4.4}$

The transverse tests were made with the stones resting on end supports 19 inches apart and loaded at the middle over a bearing 1 inch wide.

The modulus of rupture, R, was computed from the formula $R = \frac{3Pl}{2bd^2}$.

Shearing tests were made with the stones resting upon blocks 6 inches apart and loaded upon a plunger having a face 5 inches wide; hence the clearance between the sides of the plunger and blocks was one-half inch on a side.

Before the shearing strength was reached tension fractures were developed on the under side of the stone midway the 6-inch free span, and there were instances in which longitudinal fractures opened in the ends of the stones, corresponding to shearing along the grain in the tests of timber.

These fractures occurred first, the direct shearing fractures being the final ones.

Modifications in the arrangement of the supporting blocks were made and endwise movement of the stone restricted by firmly securing steel blocks abutting against the ends of the stone. The manner of failure and order of fractures, however, remained as in the first instance.

Photographs follow the details of the tests illustrating these fractures.

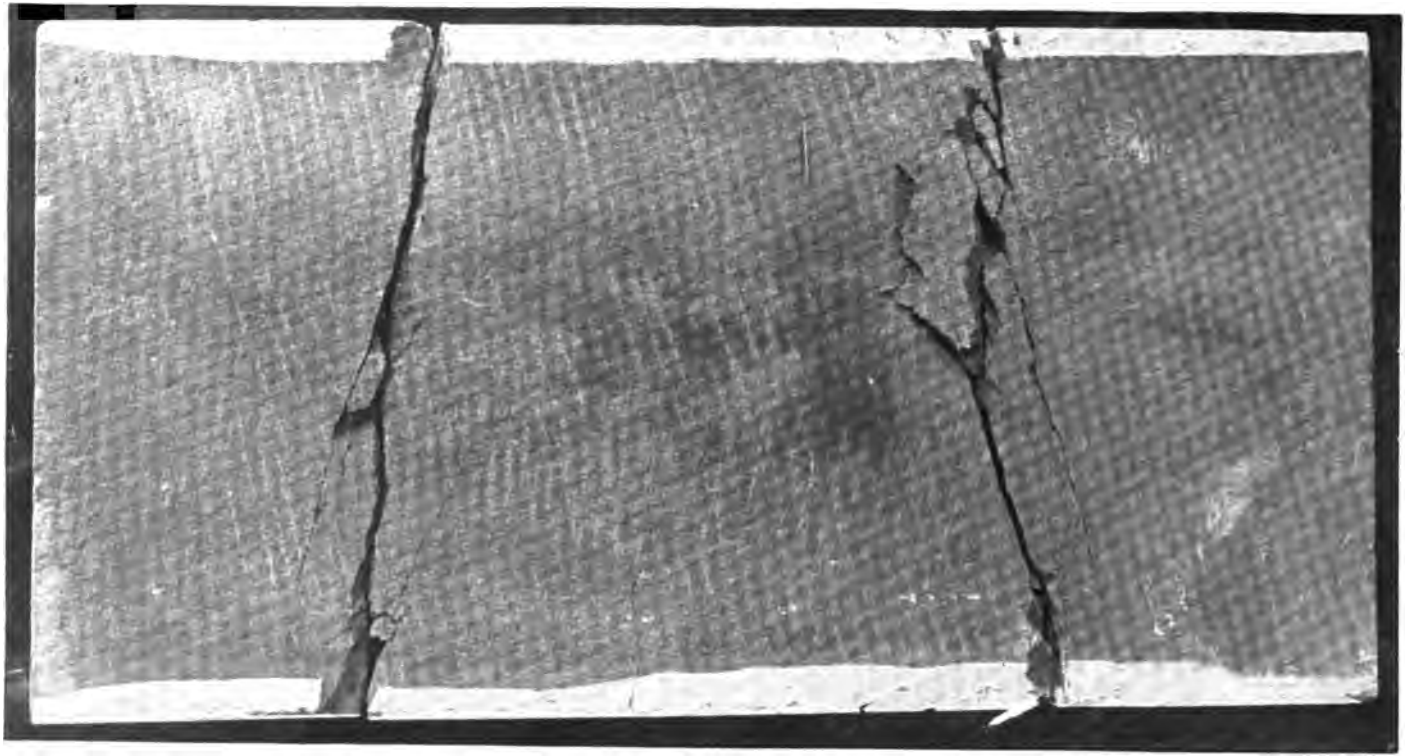
An extended series of observations has been inaugurated on the effect of different temperatures and exposure to moisture on the expansion or swelling of stones.

The transverse specimens were prepared with small plugs in one face, 20 inches apart, which plugs were drilled and countersunk for the purpose of establishing a definite gauged length which could be subsequently measured while the stones were exposed to different conditions.

The stones were immersed in cold and in hot water baths and in a hot-air tank, and while in these baths their gauged lengths were measured.

A reference bar for comparison of length was kept at all times in the cold-water bath, near the temperature of the melting point of ice.

The reference bar had drilled and countersunk holes 20 inches apart, similar to the stones.



THE SHEARING STRENGTH OF STONES.

Photograph of fractured specimen of Maynard sandstone, East Longmeadow, Mass.

A micrometer, mounted on a frame carrying conical points, was used in making the comparisons of lengths. The instrument was in a degree protected from rapid changes in temperature by a felt covering.

The influence of temperature changes on the length of the micrometer was eliminated in the results so far as possible by making a number of observations alternately on the reference bar and on the stone—usually five on each were taken—and the mean of these readings was accepted.

The highest degree of accuracy in these measurements was apparently obtained while the stones were in the cold water. Here the stones and the reference bar had the same temperature, and the micrometer consequently was exposed nearly to constant temperature conditions.

The variations in the apparent length of the stones as compared with the reference bar were within one one-thousandth of an inch; hence the mean results of the five readings were believed to very accurately establish the length of the stones at this time.

While in the hot baths, either in water or in air, the opportunity for accurate measurements was less favorable, and although there were instances in which the micrometer readings were taken with no greater apparent variations than on the cold stones, generally, however, the micrometer was sensibly affected by temperature changes in being used alternately over the cold-water bath and then the hot bath, and variations in readings of nearly ″.0020 were encountered.

From the progressive manner in which the changes in the length of the micrometer occurred during most of the experiments it is believed that the final results indicate the length of the stones in the hot baths with an error of less than one one-thousandth of an inch.

A series of diagrams is presented illustrating the behavior of the stones under the influence of the hot and cold baths and how prolonged exposure to certain conditions affect their dimensions.

The diagrams have curves graphically showing the changes in length of the stones, which are also figured, giving the mean results of the observations in ten-thousandths of an inch.

These changes in length refer in each case to the gauged length of about 20 inches, as defined by the plugs before described.

The initial readings were taken, with few exceptions, on the stones before entering the water baths, the specimens since received for testing having remained in the open air exposed to ordinary summer temperatures.

The columns on the diagrams headed "Treatment" describe what occurred with the stones, while the columns headed "Time" and "Temperature" state the interval of time and temperature the specimens were exposed to the condition mentioned in the first column.

The total effect produced was an expansion when the curve is plotted above the datum line; a contraction when below.

Diagram No. 1 shows the behavior of a granite specimen from Brandford, Conn.

When measured in air the gauged length was 20″.0046, and this was the initial or zero length as plotted on the curve.

After immersion in water in the storage tank, and remaining there a period of eight days, the stone was again measured, at which time it was found ″.0011 longer than at the first measurement, although the temperature was lower than in the first instance.

The stone was next put in the cold-water bath, and after a period of forty hours in the bath the gauge length measured the same as originally.

Next followed immersion in the hot-water bath, and after six hours time the stone showed an expansion of ″.0184. When subsequently cooled to 34° F. there remained a permanent expansion of ″.0043.

At a later period the stone was heated to a higher temperature, about 415° F., the expansion appeared to be ″.0576, and there remained a greater permanent set than before. At 87° F. the stone was ″.0142 longer on the gauged length than when originally measured.

The temperatures of specimens in the hot-air tank are defined only approximately.

Temporary apparatus was employed for heating, and the higher temperatures were reached chiefly for the purpose of ascertaining the general effect of these temperatures on the stones, and for dispelling moisture absorbed while in the water baths.

The coefficient of expansion for this and the other stones illustrated by this series of diagrams was computed from the range in temperature and the difference in lengths between the two readings marked by asterisks.

The contractions in length under descending temperatures were used in the computations on account of permanent sets being generally developed by the treatment given the samples.

In the specimen of Branford granite there appears to be evidence that two effects have resulted from exposure to the baths.

There seems to have been a slight swelling of the stone when first measured in the cold water bath at 34° F., for the gauged length was the same as when first measured in the open air, notwithstanding the reduction in temperature of 36° F.

Then after exposure in the hot-water bath its length, when returned to the cold-water bath, was greater than before, and a still greater permanent set followed its exposure to the hot-air bath.

From these indications it would appear that both the absorption of water and elevation of temperature tended to cause a permanent expansion of the stone.

The following sample of Milford granite showed a similar behavior:

After having been heated to about 406° F. there was an interval of a number of days in which the stone remained part of the time in the open air and part of the time in the storage tank of water, and then followed its immersion in the cold and hot water baths, the final measurement being taken while in the cold bath.

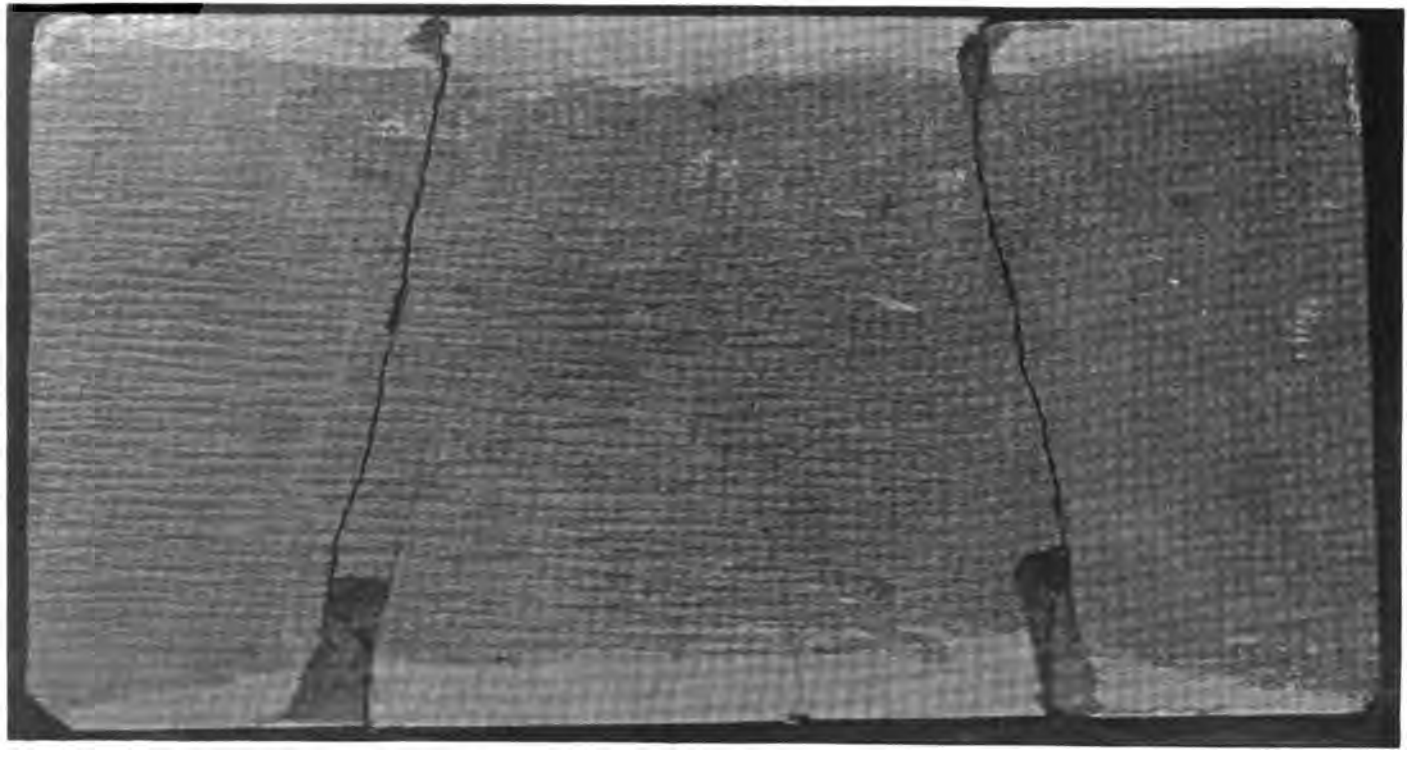
The stone finally passed through the range of temperature from 34° to 212° and returned to 34° without additional set.

For the purpose of eliminating the effect of absorption of moisture, a second specimen of Milford granite was prepared and placed in a watertight brass case. Tubulures on the upper side of the case gave access to the gauged length of the specimen.

This specimen was observed in the water baths, from which it appeared there was a slight increase in length or permanent expansion due to the temperature of the hot-water bath.

Too much reliance can not be placed upon these indications, which do not greatly exceed in amount the possible errors of observation; however, the apparent behavior of the stone harmonizes with other observations of the series, and therefore inspires confidence in the reliability of the micrometer observations.

The effect when this stone entered the cold bath was to diminish its length over its dimension at 90° F., whereas the duplicate sample was a little longer the first time in the cold water bath than when in the open air at a higher temperature.



THE SHEARING STRENGTH OF STONES.

Photograph of fractured specimen of sandstone from The Cooper Sandstone Quarry Company, Douglas County, Oreg.

The behavior of the specimen of Troy granite, shown on diagram No. 4, was similar to the first Milford granite specimen.

The marble specimen from the Creole Quarry of the Georgia Marble Company, shown on diagram No. 5, was heated in the hot-air tank to the temperature of about 460° F., and slowly cooled in the tank for the purpose of ascertaining the amount of permanent expansion caused by this degree of heat, checking the results obtained with the specimen from the Cherokee Quarry belonging to the same marble company, shown in diagram 6.

Each of the marbles shown on diagrams Nos. 5, 6, and 7 acquired large permanent expansion, due to exposure to temperature between 400° and 500° F.

Stones shown on diagrams Nos. 6 and 7 were examined after exposure to the temperature of boiling water, and at this stage a decided permanent set had developed, but the higher temperatures of the hot-air bath proportionately appeared to give greater sets.

These preliminary trials will be supplemented by a careful examination of stones after exposure to different temperatures covering the full range to which this class of material may be exceptionally subjected. Investigations of this nature may be essential in order to understand the relative fire-resisting qualities of stones.

The second specimen of marble from a quarry belonging to the Charles River Stone Company, and located at Marble Hill, Ga., was tested in an hermetically sealed brass case.

The permanent expansion which this stone displayed after exposure to the temperature of boiling water added further confirmation to the indications that a small range of temperature causes an expansion of these metamorphic rocks which has the appearance of being a permanent change.

Touching upon the question of the permanence of these expansions—they are provisionally so-called—a critical examination of the lengths of the stones after the lapse of a longer interval of time than covered by these experiments will be necessary to demonstrate whether there is a tendency to recover from these sets or not.

Diagrams Nos. 9 and 10 show the behavior of stones from Lee, Mass., and Tuckahoe, N. Y., both of which are dolomites.

These appear to be very slightly, if at all, expanded by the absorption of water, and the development of permanent sets is much less pronounced than in the marbles just described.

How far these results are dependent upon the chemical composition of the material a more extended number of tests will be necessary to establish.

In these crystallized rocks the marbles acquire much greater sets when tested over these experimental ranges of temperatures than the dolomites.

The behavior of the limestones which follow on diagrams Nos. 11 and 12 more closely resemble the dolomites than the marbles in respect to the development of sets, although in chemical composition these limestones are intermediate between the two classes of stones mentioned in respect to the amount of magnesia contained.

The Oolitic limestone on diagram No. 12 had been previously experimented with, and on the earlier occasion the coefficient of expansion appeared to be a little lower than here determined.

The Monson slate shown on diagram No. 13 also showed a slightly lower coefficient of expansion when that was examined on an earlier occasion. Report of Tests, 1892, contains these earlier experiments.

The slate specimen shows a more uniform behavior over the range of experimental temperatures than the stones hereinbefore described.

After exposure to the hot-water bath it returned to its former length when placed in the cold bath, and after exposure to the higher temperature of the hot-air bath its length when cooled to 90° F. showed a nearly uniform rate of contraction.

Diagram No. 14 shows the behavior of an Oregon sandstone from the Cooper Sandstone Quarry, Douglas County.

This stone was remarkable for his behavior under the influence of moisture.

The first observation on the gauged length was made after it had been four hours in the cold-water bath.

The measurements were repeated again after a further interval of forty hours, at which time the stone had expanded ″.0130, the temperature in the meantime having remained constant at 34° F.

It was then placed in the hot-water bath, and, after measuring, returned to the cold water, when the length had increased ″.0239.

The moisture was then expelled, in part at least, by drying the stone on a screen placed over a steam boiler, where the temperature of the stone reached about 110° F.

This drying off caused a reduction in the amount of the set; when, however, the stone was again exposed to the moisture of the cold-water bath the action of the water was renewed, and additional swelling of the stone went on.

At the expiration of twenty-two hours the stone in the cold-water bath, at 34° F., had gained so much that it was longer than in the hot water at 204° F.

At the end of fifteen days, without change in temperature, the stone appeared to have reached a state in which expansion ceased, an additional interval of twenty hours practically showing no change.

Then followed other exposures in the hot water, each of which appeared to increase the ability of the stone to expand, until the gauged length had been increased the total amount of ″.0512.

The stone was then heated in hot air to about 410° F. At this time two opposite influences seemed to be at work; there was the dilatation due to the heating, and the contractile effect resulting from expelling moisture, hence the total expansion on the gauged length was only ″.0129 for an elevation in temperature of about 376° F.

A decided diminution in length was found when the stone had cooled in the air.

The amount of set was reduced from ″.0512 when last in the cold water to ″.0332, its present length in air at 80° F.

But this diminution in length was lost when the stone was again exposed in a water bath. It was kept in the storage tank one hundred and twenty-seven hours, then placed in the cold-water bath, where it remained three hundred and ten hours, gradually gaining in length until the expansion was ″.0541.

It was again placed in the hot-water bath and returned to the cold water, then went into the storage tank.

The value of the coefficient of expansion of this stone remains vague and uncertain. The computed value based on the last observations in the hot-water and cold-water bath is given only as an approximation.

Whereas with the marbles it was shown that the effect of heating was to develop a decided permanent expansion, moisture producing a less marked effect, in the case of this sandstone moisture causes a large expansion, and heat diminished the permanent set.

THE SHEARING STRENGTH OF STONES.
Photograph of fractured specimen of limestone from Mount Vernon, Ky.

The use of the expression "permanent set" in connection with the behavior of these stones seems hardly justifiable. It is used, however, in the conventional sense, meaning the residual change, or what remains of the temporary effect of a given treatment when the material is returned to a former state of temperature or condition.

Further investigations will be undertaken for the purpose of ascertaining, if possible, why heat in one stone increases the permanent set and in another diminishes it.

Experiments will be continued with this particular sandstone.

It is thought that the sandstones shown on diagrams Nos. 15, 16, and 17 were each, in a measure, affected both by heat and moisture.

The Olympia sandstone, shown on diagram No. 19, evidently swells in the water in a decided manner.

The Potomac red sandstone had been experimented with, and the results recorded in Report of Tests, 1890.

Its behavior indicated a very slight influence from either heat or moisture in respect to causing the development of permanent sets.

The prism of Dyckerhoff's cement was initially measured after setting one day in air, then measured after fifteen days setting in water, and again after remaining sixty-eight days in the storage tank.

The results showed an expansion in each case, due apparently to the action of the water in addition to the dilatation by heat. After exposure to the hot-water bath the expansion was found to be increased in amount.

This specimen was set in water and examined in comparison with a duplicate prism set in air.

The duplicate prism was first measured after setting fourteen days in air, and the measurement repeated after a further interval of fifty-three days.

The contraction, on the gauged length 20″.0179, which occurred during this interval of fifty-three days, was ″.0128, the initial and final temperatures being 70° and 87° F., respectively.

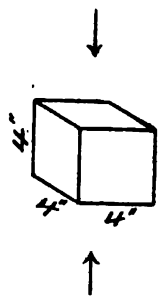
Applying a correction for the changes in length due to change in temperature, using the coefficient ″.00000578, it would appear that the net contraction was ″.0148.

NATURAL STONES.

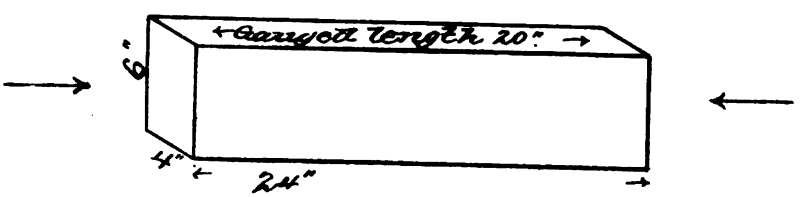
COMPRESSION TESTS.

Tests of Stones.

Forms of specimens.



For compression tests.



For Compression elastic properties, Coefficients of expansion by heat and Transverse strength.

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NATURAL STONES.

COMPRESSION TESTS.

Stones from the Charles River Stone Company, Boston Mass.

[Quarries located as below described.]

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
6908	Milford granite, Milford, Mass	3.99	4.05	4.05	16.40	263,000	417,400	25,451
6909	....do	4.01	4.06	4.05	16.44	125,000	316,000	19,258
6910	....do	4.01	4.08	4.10	16.73	209,000	430,600	25,738
6911	Brandford granite, Brandford, Conn	4.02	4.06	4.00	16.24	97,000	252,700	15,560
6912	....do	4.03	4.03	4.04	16.28	111,000	258,100	15,854
6913	Troy granite, Troy, N. H	4.00	4.05	4.01	16.24	412,000	467,200	28,768
6914	....do	3.99	4.02	4.03	16.20	382,000	382,000	23,580
6915	Maynard sandstone, East Longmeadow, Mass	2.98	3.97	3.98	15.80	125,000	166,500	10,538
6916	....do	3.98	3.98	3.98	15.84	142,000	146,100	9,223
6917	Kibbe sandstone, East Longmeadow, Mass	3.99	3.98	3.99	15.88	150,000	159,800	10,063
6918	....do	3.98	3.98	3.98	15.84	164,000	168,900	10,663
6919	Worcester sandstone, East Longmeadow, Mass	4.00	4.00	4.00	16.00	154,500	154,500	9,656
6920	....do	4.00	4.00	4.01	16.04	146,000	158,300	9,869
6921	Southern marble, Marble Hill, Ga	4.00	4.04	4.04	16.32	188,200	188,200	11,532
6922	....do	4.01	4.02	4.04	16.24	186,400	186,400	11,478
6923	Tuckahoe marble, Tuckahoe, N. Y	4.00	4.02	4.02	16.16	98,000	188,100	11,640
6924	....do	3.99	4.04	4.02	16.24	271,300	288,200	17,746
6925	....do	4.00	4.00	4.02	16.08	309,100	309,100	19,223

Granite from the Milford Pink Granite Company, Boston, Mass.

[Quarries at Milford, Mass.]

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
6873	.....	4.00	4.01	4.06	16.28	185,000	360,800	22,162
6874	.....	4.03	4.01	4.06	16.28	198,000	310,100	19,047
6875	.....	4.01	4.02	4.01	16.12	165,000	254,000	15,756

Granite from the Pigeon Hill Granite Company, Rockport, Mass.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
6870	.....	3.99	4.00	4.04	16.16	94,000	287,200	17,772
6871	.....	3.98	3.98	4.07	16.20	79,000	335,600	20,716
6872	.....	4.00	4.04	4.03	16.28	86,000	334,100	20,522

Samples 6870, 6871, and 6872 continued cracking at frequent intervals after the first crack occurred until the ultimate strength was reached.

Marble from the Georgia Marble Company, Tate, Ga.

No. of test.	Name of quarry.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
6926	Creole	3.99	3.99	3.99	15.92	165,000	181,800	11,420
6927	.....do	4.00	4.00	4.00	16.00	248,200	248,200	15,512
6928	Cherokee	3.99	4.00	3.99	15.96	214,100	214,100	13,415
6929	.....do	4.00	3.99	3.99	15.92	168,000	188,200	11,822
6930	Etowah	4.00	4.00	3.99	15.96	226,900	226,900	14,217
6931	.....do	3.99	3.99	3.99	15.92	221,100	221,100	13,888
6932	Kennesaw	4.00	4.01	4.00	16.04	122,300	134,000	8,354
6933	.....do	4.00	4.02	4.00	16.08	172,900	173,200	10,771

Limestone from Dr. A. G. Lovell, Mount Vernon, Ky.

[Quarries at Mount Vernon, Ky.]

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
6899	I	3.98	4.03	4.12	16.60	41,000	87,100	5,247
6900	I	3.89	3.99	4.00	15.96	78,000	98,900	6,197
6901	I	4.07	3.99	4.05	16.16	116,000	186,900	11,566
6902	II	3.99	4.11	4.02	16.52	81,000	160,300	9,703
6903	II	4.04	4.10	4.01	16.44	92,000	118,800	7,226
6904	II	4.04	4.00	4.07	16.28	94,000	151,100	9,281
6905	III	4.03	4.01	4.07	16.32	101,000	108,000	6,618
6906	III	3.99	4.04	4.06	16.40	56,000	103,400	6,305
6907	III	4.02	4.02	4.01	16.12	98,000	107,700	6,681

Sandstone from the Cooper Sandstone Quarry, Douglas County, Oreg.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
6940	I	4.01	4.05	4.15	16.81	250,000	250,800	14,920
6941	II	3.99	4.10	4.04	16.56	151,000	235,200	14,203
6942	III	4.03	4.02	4.17	16.76	234,000	274,300	16,366

Sandstone from the Olympia Sandstone Quarry, Olympia, Oreg.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7175		4.02	4.05	4.04	16.36	154,000	219,900	13,441
7176		4.03	4.07	4.03	16.40	195,000	197,800	12,061
7177		4.05	4.02	4.04	16.24	202,900	202,900	12,494

Sandstone from the Chuckanut Quarries, Chuckanut or Whatcom, Wash.

No. of test.	Marks.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*
7178		3.99	4.22	4.20	17.72	179,000	182,100	10,276
7179		4.09	4.13	4.20	17.35	183,000	221,900	12,790
7180		4.20	4.21	4.23	17.81	192,000	197,700	11,100

NATURAL STONES.

COMPRESSIVE ELASTIC PROPERTIES.

NATURAL STONES.

BRANDFORD GRANITE, FROM BRANDFORD, CONN.

No. 6960.

Length, 24″.02.
Sectional area, 6″.07 × 4″.08 = 24.76 square inches.
Weight, 55¾ pounds = 162 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,476	100	0.	0.	Initial load.
4,952	200	.0004	.....	
9,904	400	.0012	.....	
14,856	600	.0020	.....	
19,808	800	.0026	.....	
24,760	1,000	.0032	.0004	
37,140	1,500	.0045	.....	
49,520	2,000	.0057	.....	
61,900	2,500	.0070	.....	
74,280	3,000	.0082	.0006	E = 8,333,300 pounds between 1,000 pounds and 3,000 pounds per square inch.
86,660	3,500	.0094	.....	
99,040	4,000	.0105	.0007	
111,420	4,500	.0117	.....	
123,800	5,000	.0128	.0008	
136,180	5,500	.0139	.....	
148,560	6,000	.0152	.0009	
160,940	6,500	.0164	.....	
173,320	7,000	.0175	.....	
148,560	6,000	.0156	.....	
123,800	5,000	.0134	.....	
99,040	4,000	.0112	.....	
74,280	3,000	.0091	.....	
49,520	2,000	.0066	.....	
24,760	1,000	.0038	.0011	
24,760	1,000	.0033	.....	
49,520	2,000	.0059	.....	
74,280	3,000	.0084	.....	
99,040	4,000	.0107	.....	
123,800	5,000	.0131	.....	
148,560	6,000	.0153	.....	
173,320	7,000	.0175	.....	
185,700	7,500	.0186	.....	
198,080	8,000	.0197	.0012	
210,460	8,500	.0208	.....	E = 9,090,900 pounds between 7,000 pounds and 9,000 pounds per square inch.
222,840	9,000	.0220	.0012	
235,220	9,500	.0232	.....	Chips flaked off two corners.
222,840	9,000	.0224	.....	
198,080	8,000	.0204	.....	
173,320	7,000	.0183	.....	
148,560	6,000	.0163	.....	
123,800	5,000	.0141	.....	
99,040	4,000	.0118	.....	
74,280	3,000	.0094	.....	
49,520	2,000	.0069	.....	
24,760	1,000	.0042	.0013	
24,760	1,000	.0036	.....	
49,520	2,000	.0062	.....	
74,280	3,000	.0088	.....	
99,040	4,000	.0111	.....	
123,800	5,000	.0134	.....	
148,560	6,000	.0157	.....	
173,320	7,000	.0179	.....	
198,080	8,000	.0201	.....	
173,320	7,000	.0181	.....	
198,080	8,000	.0201	.....	
173,320	7,000	.0182	.....	
198,080	8,000	.0201+	.....	
173,320	7,000	.0182	.....	
148,560	6,000	.0163	.....	

No. 6960—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
123, 800	5, 000	.0140	.....	
99, 040	4, 000	.0117	.....	
74, 280	3, 000	.0094+	.....	
99, 040	4, 000	.0116	.....	
74, 280	3, 000	.0094	.....	
99, 040	4, 000	.0116	.....	
74, 280	3, 000	.0094+	.....	
49, 520	2, 000	.0071	.....	
24, 760	1, 000	.0042	.0014	
24, 760	1, 000	.0037	.0014	
24, 760	1, 000	.0037	.0014	

Lateral expansion under endwise compressive loads. Transverse gauged length, $5\frac{1}{2}''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2, 476	100	0.	0.	Initial load.
99, 040	4, 000	.0006	.....	
198, 080	8, 000	.0013	.....	
99, 040	4, 000	.0007	0.	
99, 040	4, 000	.0007	.....	
198, 080	8, 000	.0013+	.....	
99, 040	4, 000	.0007+	0.	Test discontinued.

MILFORD GRANITE, FROM MILFORD, MASS.

No. 6959.

Length, 23″.98.
Sectional area, 6″.06×4″.06=24.60 square inches.
Weight, 55½ pounds=162.5 pounds per cubic foot.
Ganged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,460	100	0.	0.	Initial load.
4,920	200	.0006	.....	
9,840	400	.0020	.....	
14,760	600	.0031	.....	
19,680	800	.0042	.....	
24,600	1,000	.0052	.0009	
36,900	1,500	.0076	.....	
49,200	2,000	.0096	.0014	
61,500	2,500	.0115	.....	
73,800	3,000	.0131	.0017	E=5,633,800 pounds between 1,000 pounds and 3,000 pounds per square inch.
86,100	3,500	.0147	.....	
98,400	4,000	.0160	.0020	
110,700	4,500	.0174	.....	
123,000	5,000	.0188	.0021	
135,300	5,500	.0201	.....	
147,600	6,000	.0216	.0025	Chips flew off one corner.
159,900	6,500	.0229	.....	E=7,843,100 pounds between 4,000 pounds and 6,000 pounds per square inch.
172,200	7,000	.0242	.....	
147,600	6,000	.0221	.....	
123,000	5,000	.0198	.....	
98,400	4,000	.0174	.....	
73,800	3,000	.0148	.....	
49,200	2,000	.0118	.....	
24,600	1,000	.0081	.0026	
24,600	1,000	.0068	.....	
49,200	2,000	.0107	.....	
73,800	3,000	.0139	.....	
98,400	4,000	.0166	.....	
123,000	5,000	.0193	.....	
147,600	6,000	.0218	.....	
123,000	5,000	.0196	.....	
98,400	4,000	.0173	.....	
73,800	3,000	.0147	.....	
49,200	2,000	.0118	.....	
24,600	1,000	.0080	.0026	
24,600	1,000	.0068	.....	
49,200	2,000	.0107	.....	
73,800	3,000	.0138	.....	
98,400	4,000	.0166	.....	
73,800	3,000	.0143	.....	
49,200	2,000	.0115	.....	
24,600	1,000	.0078	.0026	

Lateral expansion under endwise compressive loads.
Transverse gauged length, $5\frac{1}{2}''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,460	100	0.	0.	Initial load.
49,200	2,000	.0002	.....	
98,400	4,000	.0005	.....	
147,600	6,000	.0009	.....	
98,400	4,000	.0006	.....	
49,200	2,000	.0004	.0001	
49,200	2,000	.0003	.....	
98,400	4,000	.0006	.....	
147,600	6,000	.0009	.....	
98,400	4,000	.0006	.....	
49,200	2,000	.0003+	.0001	
147,600	6,000	.0010	.0001	
147,600	6,000	.0010	.0001	
49,200	2,000	.0003+	.....	
98,400	4,000	.0006	.....	
147,600	6,000	.0010	.....	
98,400	4,000	.0006+	.....	
49,200	2,000	.0004	.0001	Test discontinued.

MILFORD GRANITE, FROM MILFORD, MASS.

No. 6989.

Length, $24''.02$.
Sectional area, $6''.00 \times 3''.99 = 23.94$ square inches.
Gauged length, $20''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,394	100	0.	0.	Initial load.
4,788	200	.0003	.....	
9,576	400	.0009	.....	
14,364	600	.0015	.....	
19,152	800	.0021	.....	
23,940	1,000	.0028	.0001	
47,880	2,000	.0056	.0004	
71,820	3,000	.0086	.0007	E = 7,692,300 pounds between 1,000 pounds and 3,000 pounds per square inch.
95,760	4,000	.0112	.0009	
119,700	5,000	.0137	.....	
95,760	4,000	.0115	.....	
71,820	3,000	.0095	.....	
47,880	2,000	.0071	.....	
23,940	1,000	.0044	.....	
2,394	100	.....	.0010	
23,940	1,000	.0040	.....	
47,880	2,000	.0065	.....	
71,820	3,000	.0090	.....	
95,760	4,000	.0113	.....	
119,700	5,000	.0136	.....	
143,640	6,000	.0161	.....	
167,580	7,000	.0183	.....	
191,520	8,000	.0206	.0013	
215,460	9,000	.0229	.0015	E = 9,523,800 pounds between 8,000 pounds and 9,000 pounds per square inch.
590,000	24,644	.....	.....	Ultimate strength.

TROY GRANITE FROM TROY, N. H.

No. 6961.

Length, 24″.01.
Sectional area, 6″.03 × 4″.04 = 24.36 square inches.
Weight, 55¾ pounds = 164.7 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,436	100	0.	0.	Initial load.
4,872	200	.0010	.....	
9,744	400	.0030	.....	
14,616	600	.0049	.....	
19,488	800	.0064	.....	
24,360	1,000	.0079	.0019	
36,540	1,500	.0110	.....	
48,720	2,000	.0137	.0029	
60,900	2,500	.0160	.....	
73,080	3,000	.0182	.0034	E = 4,545,400 pounds between 1,000 pounds and 3,000 pounds per square inch.
85,260	3,500	.0201	.....	
97,440	4,000	.0219	.0040	
109,620	4,500	.0236	.....	
121,800	5,000	.0252	.0044	
133,980	5,500	.0269	.....	
146,160	6,000	.0285	.0047	
158,340	6,500	.0301	.....	
170,520	7,000	.0317	.....	
146,160	6,000	.0294	.....	
121,800	5,000	.0268	.....	
97,440	4,000	.0240	.....	
73,080	3,000	.0210	.....	
48,720	2,000	.0175	.....	
24,360	1,000	.0127	.0052	
24,360	1,000	.0109	.....	
48,720	2,000	.0156	.....	
73,080	3,000	.0195	.....	
97,440	4,000	.0228	.....	
121,800	5,000	.0258	.....	
146,160	6,000	.0289	.....	
170,520	7,000	.0317	.....	
121,800	5,000	.0289	.....	
73,080	3,000	.0211	.....	
24,360	1,000	.0129	.0054	
24,360	1,000	.0112	.....	
73,080	3,000	.0196	.....	
121,800	5,000	.0264	.....	
170,520	7,000	.0322	.....	
182,700	7,500	.0335	.....	
194,880	8,000	.0349	.0059	E = 7,692,300 pounds between 7,000 pounds and 9,000 pounds per square inch.
207,060	8,500	.0363	.....	
219,240	9,000	.0379	.0062	Chips flaked off at one corner.
231,420	9,500	.0394	.....	
243,600	10,000	.0411	.....	
219,240	9,000	.0389	.....	
194,880	8,000	.0365	.....	
170,520	7,000	.0342	.....	
146,160	6,000	.0316	.....	
121,800	5,000	.0289	.....	
97,440	4,000	.0260	.....	
73,080	3,000	.0227	.....	
48,720	2,000	.0191	.....	
24,360	1,000	.0143	.0065	
24,360	1,000	.0122	.....	
48,720	2,000	.0170	.....	
73,080	3,000	.0208	.....	
97,440	4,000	.0242	.....	
121,800	5,000	.0274	.....	
146,160	6,000	.0302	.....	
170,520	7,000	.0330	.....	
194,880	8,000	.0358	.....	
219,240	9,000	.0385	.....	
170,520	7,000	.0340	.....	
121,800	5,000	.0288	.....	
73,080	3,000	.0227	.....	
24,360	1,000	.0144	.0067	

Lateral expansion under endwise compressive loads.
Transverse gauged length, .5½″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,436	100	0.	0.	Initial load.
121,800	5,000	.0009	.....	
219,240	9,000	.0017	.....	
121,800	5,000	.0012	0.	
121,800	5,000	.0009	.....	
219,240	9,000	.0018	.....	
121,800	5,000	.0012	.0001	
121,800	5,000	.0009+	.....	
219,240	9,000	.0018	.....	
121,800	5,000	.0012	.0001	Test discontinued.

MILFORD PINK GRANITE FROM MILFORD PINK GRANITE COMPANY, BOSTON, MASS.

No. 6877.

Length, 24″.05.
Sectional area, 6″.03 × 4″.03=24.3 square inches.
Weight, 54¾ pounds=161.9 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,430	100	0.	0.	Initial load.
4,860	200	.0007	.....	
9,720	400	.0018	.....	
14,580	600	.0029	.....	
19,440	800	.0039	.....	
24,300	1,000	.0050	.0006	
29,160	1,200	.0059	.....	
34,020	1,400	.0068	.....	E=5,128,000 pounds between 1,000 pounds and 2,000 pounds per square inch.
38,880	1,600	.0077	.....	
43,740	1,800	.0086	.....	
48,600	2,000	.0095	.0012	
58,320	2,400	.0112	.....	
68,040	2,800	.0127	.....	
77,760	3,200	.0142	.....	
87,480	3,600	.0156	.....	
97,200	4,000	.0171	.0021	
106,920	4,400	.0183	.....	
116,640	4,800	.0196	.....	
126,360	5,200	.0208	.....	
136,080	5,600	.0220	.....	
145,800	6,000	.0233	.0026	
48,600	2,000	.0115	.....	
97,200	4,000	.0178	.....	
145,800	6,000	.0234	.....	
97,200	4,000	.0185	.....	
48,600	2,000	.0127	.0026	
155,520	6,400	.0244	.....	
165,240	6,800	.0256	.....	
174,960	7,200	.0267	.....	
184,680	7,600	.0278	.....	
194,400	8,000	.0289	.0027	E=7,272,700 pounds between 6,000 pounds and 8,000 pounds per square inch.
204,120	8,400	.0302	.....	
213,840	8,800	.0312	.....	Snapping sound. Small pieces flaked off top.
223,560	9,200	.0323	.....	
233,280	9,600	.0334	.....	
243,000	10,000	.0344	.0034	
58,320	2,400	.....	.....	Rested 15 hours under this load.
2,430	100	.....	.0031	
48,600	2,000	.0122	.....	
97,200	4,000	.0185	.....	
145,800	6,000	.0240	.....	
194,400	8,000	.0293	.....	
145,800	6,000	.0247	.....	
97,200	4,000	.0190	.....	
48,600	2,000	.0136	.0031	
48,600	2,000	.0122	.....	
97,200	4,000	.0186	.....	
145,800	6,000	.0242	.....	
97,200	4,000	.0193	.....	
48,600	2,000	.0134	.0032	
48,600	2,000	.0124	.....	
97,200	4,000	.0187	.....	
48,600	2,000	.0131	.0032	
48,600	2,000	.0124	.0032	Test discontinued.

This specimen used in transverse test No. 203.

GRANITE FROM PIGEON HILL GRANITE COMPANY, ROCKPORT, MASS.

No. 6876.

Length, 24″.
Sectional area, 6″.06×4″.01=24.3 square inches.
Weight, 54½ pounds=161.5 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,430	100	0.	0.	Initial load.
4,860	200	.0002	.....	
9,720	400	.0010	.....	
14,580	600	.0017	.....	
19,440	800	.0025	.....	
24,300	1,000	.0031	.0002	
29,160	1,200	.0038	.....	
34,020	1,400	.0044	.....	E=6,666,700 pounds between 1,000 pounds and 2,000 pounds per square inch.
38,880	1,600	.0051	.....	
43,740	1,800	.0057	.....	
48,600	2,000	.0063	.0004	
58,320	2,400	.0075	.....	
68,040	2,800	.0085	.....	
77,760	3,200	.0095	.....	
87,480	3,600	.0106	.....	
97,200	4,000	.0116	.0006	
106,920	4,400	.0125	.....	
116,640	4,800	.0134	.....	
126,360	5,200	.0144	.....	
136,080	5,600	.0153	.....	
145,800	6,000	.0162	.0009	
48,600	2,000	.0065	.....	
97,200	4,000	.0116	.....	
145,800	6,000	.0162	.....	
97,200	4,000	.0120	.....	
48,600	2,000	.0071	.0009	
155,520	6,400	.0172	.....	
165,240	6,800	.0181	.....	
174,960	7,200	.0190	.....	
184,680	7,600	.0199	.....	
194,400	8,000	.0208	.0011	
48,600	2,000	.0066	.....	
97,200	4,000	.0117	.....	
145,800	6,000	.0164	.....	
194,400	8,000	.0209	.....	
145,800	6,000	.0167	.....	
97,200	4,000	.0123	.....	
48,600	2,000	.0075	.0011	
204,120	8,400	.0217	.....	
213,840	8,800	.0226	.....	
223,560	9,200	.0235	.....	
233,280	9,600	.0243	.....	
243,000	10,000	.0253	.....	
194,400	8,000	.0213	.....	
145,800	6,000	.0170	.....	
97,200	4,000	.0125	.....	
48,600	2,000	.0075	.0011	
48,600	2,000	.0068	.....	
97,200	4,000	.0119	.....	
145,800	6,000	.0165	.....	
194,400	8,000	.0210	.....	
243,000	10,000	.0253	.....	
252,720	10,400	.0261	.....	
262,440	10,800	.0270	.....	
272,160	11,200	.0280	.....	
281,880	11,600	.0288	.....	Snapping sound, but no cracks in sight. E=9,523,800 pounds between 10,000 pounds and 12,000 pounds per square inch.
291,600	12,000	.0297	.....	
243,000	10,000	.0258	.....	
194,400	8,000	.0216	.....	
145,800	6,000	.0175	.....	
97,200	4,000	.0129	.....	
48,600	2,000	.0078	.0013	

No. 6876—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
48,600	2,000	.0070	.....	
97,200	4,000	.0122	.....	
145,800	6,000	.0168	.....	
194,400	8,000	.0213	.....	
243,000	10,000	.0255	.....	
194,400	8,000	.0215	.....	
145,800	6,000	.0173	.....	
97,200	4,000	.0128	.....	
48,600	2,000	.0078	.0015	Test discontinued.

This specimen used in transverse test No. 205.

GEORGIA MARBLE FROM CREOLE QUARRY.

No. 6967.

Length, 23″.93.
Sectional area, 6″.02 × 4″.02 = 24.2 square inches.
Weight, 57 pounds = 170 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,420	100	0.	0.	Initial load.
4,840	200	.0002	.....	
9,680	400	.0006	.....	
14,520	600	.0011	.....	
19,360	800	.0017	.....	
24,200	1,000	.0024	.0003	
48,400	2,000	.0058	.0008	
72,600	3,000	.0088	.0009	E = 6,896,500 pounds between 1,000 pounds and 3,000 pounds per square inch.
96,800	4,000	.0113	.0011	
121,000	5,000	.0138	.0013	
145,200	6,000	.0163	.....	
121,000	5,000	.0144	.....	
96,800	4,000	.0126	.....	
72,600	3,000	.0106	.....	
48,400	2,000	.0084	.....	
24,200	1,000	.0057	.....	
2,420	100	.....	.0015	
24,200	1,000	.0053	.....	
48,400	2,000	.0080	.....	
72,600	3,000	.0103	.....	
96,800	4,000	.0124	.....	
121,000	5,000	.0143	.....	
145,200	6,000	.0164	.....	
169,400	7,000	.0186	.....	E = 9,090,900 between 5,000 pounds and 7,000 pounds per square inch.
48,400	2,000	.0089	.....	
24,200	1,000	.0060	.....	
19,360	800	.0053	.....	
14,520	600	.0045	.....	
9,680	400	.0036	.....	
4,840	200	.0024	.....	
2,420	100	.....	.0017	
4,840	200	.0023	.....	
9,680	400	.0033	.....	
14,520	600	.0040	.....	
19,360	800	.0048	.....	
24,200	1,000	.0056	.....	
48,400	2,000	.0084	.....	
24,200	1,000	.0058	.0017	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5½″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,420	100	0.	0.	Initial load.
48,400	2,000	.0005	.....	
96,800	4,000	.0010	.....	
145,200	6,000	.0014	.....	
96,800	4,000	.0010	.....	
48,400	2,000	.0006	.....	
2,420	100	.....	0.	
145,200	6,000	.0014	.....	
2,420	100	.....	0.	Test discontinued.

Georgia Marble from Cherokee Quarry.

No. 6968.

Length, 23″.97.
Sectional area, 6″.01×4″.02=24.16 square inches.
Weight, 56¼ pounds=167.8 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,416	100	0.	0.	Initial load.
4,832	200	.0004	.....	
9,664	400	.0013	.....	
14,496	600	.0020	.....	
19,328	800	.0026	.....	
24,160	1,000	.0031	.....	
19,328	800	.0027	.....	
14,496	600	.0023	.....	
9,664	400	.0016	.....	
4,832	200	.0010	.0005	
48,320	2,000	.0057	.0006	
72,480	3,000	.0076	.0006	E=9,090,900 pounds between 1,000 pounds and 3,000 pounds per square inch.
96,640	4,000	.0095	.0006+	
120,800	5,000	.0114	.0008	
144,960	6,000	.0133	.....	E=11,764,700 pounds between 4,000 pounds and 6,000 pounds per square inch.
120,800	5,000	.0116	.....	
96,640	4,000	.0097	.....	
72,480	3,000	.0079	.....	
48,320	2,000	.0060	.....	
24,160	1,000	.0036	.....	
19,328	800	.0029	.....	
14,496	600	.0025	.....	
9,664	400	.0019	.....	
4,832	200	.0013	.0010	
4,832	200	.0011	.....	
9,664	400	.0016	.....	
14,496	600	.0021	.....	
19,328	800	.0027	.....	
24,160	1,000	.0032	.0010	

Lateral expansion under endwise compression loads.
Transverse gauged length, $5\frac{1}{2}''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,416	100	0.	0.	Initial load.
48,320	2,000	.0002	.....	
96,640	4,000	.0005	.....	
144,960	6,000	.0009	.....	
96,640	4,000	.0005	.....	
48,320	2,000	.0003	.....	
2,416	100	.....	0.	
144,960	6,000	.0009	.....	
2,416	100	.....	0.	Test discontinued.

Georgia Marble from Etowah Quarry.

No. 6969.

Length, 24″.01.
Sectional area, 6″.00 × 4″.01=24.06 square inches.
Weight, $56\frac{3}{4}$ pounds=169.8 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,406	100	0.	0.	Initial load.
4,812	200	.0006	.....	
9,624	400	.0015	.....	
14,436	600	.0023	.....	
19,248	800	.0031	.....	
24,060	1,000	.0038	.....	
19,248	800	.0033	.....	
14,436	600	.0027	.....	
9,624	400	.0020	.....	
4,812	200	.0012	.....	
2,406	100	.....	.0006	
4,812	200	.0011	.....	
9,624	400	.0018	.....	
14,436	600	.0025	.....	
19,248	800	.0032	.....	
24,060	1,000	.0038	.....	
48,120	2,000	.0067	.....	
72,180	3,000	.0093	.0010	E=7,843,100 between 1,000 pounds and 3,000 pounds per square inch.
96,240	4,000	.0117	.0013	
120,300	5,000	.0141	.0015	
144,360	6,000	.0164	.....	
120,300	5,000	.0147	.....	
96,240	4,000	.0130	.....	
72,180	3,000	.0111	.....	
48,120	2,000	.0089	.....	
24,060	1,000	.0062	.....	
19,248	800	.0054	.....	
14,436	600	.0047	.....	
9,624	400	.0038	.....	
4,812	200	.0026	.....	
2,406	100	.....	.0019	
4,812	200	.0023	.....	
9,624	400	.0032	.....	
14,436	600	.0039	.....	
19,248	800	.0046	.....	
24,060	1,000	.0052	.....	
48,120	2,000	.0082	.....	
72,180	3,000	.0105	.....	
96,240	4,000	.0125	.....	
120,300	5,000	.0145	.....	
144,360	6,000	.0165	.0020	E=9,756,100 pounds between 4,000 pounds and 6,000 pounds per square inch.

Lateral expansion under endwise compression loads.
Transverse gauged length, $5\frac{1}{2}''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,406	100	0.	0.	Initial load.
48,120	2,000	.0004	.....	
96,240	4,000	.0008	.....	
144,360	6,000	.0011	.....	
96,240	4,000	.0009	.....	
48,120	2,000	.0006	.....	
2,406	100	.....	.0001	
48,120	2,000	.0005	.....	
96,240	4,000	.0008	.....	
144,360	6,000	.0012	.....	
96,240	4,000	.0009	.....	
48,120	2,000	.0006	.....	
2,406	100	.....	.0001	
144,360	6,000	.0012	.....	
2,406	100	.....	.0001	Test discontinued.

GEORGIA MARBLE FROM KENNESAW QUARRY.

No. 6970.

Length, 23″.98.
Sectional area, 6″.00×4.″00=24.00 square inches.
Weight, 56 pounds=168.1 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,400	100	0.	0.	Initial load.
4,800	200	.0011	.....	
9,600	400	.0027	.....	
14,400	600	.0040	.....	
19,200	800	.0050	.....	
24,000	1,000	.0059	.0010	
48,000	2,000	.0090	.0013	
72,000	3,000	.0117	.0015	E=7,547,100 pounds between 1,000 pounds and 3,000 pounds per square inch.
96,000	4,000	.0142	.0017	
120,000	5,000	.0167	.0020	
144,000	6,000	.0192	.....	E=8,888,800 pounds between 4,000 pounds and 6,000 pounds per square inch.
120,000	5,000	.0173	.....	
96,000	4,000	.0155	.....	
72,000	3,000	.0133	.....	
48,000	2,000	.0111	.....	
24,000	1,000	.0081	.....	
19,200	800	.0073	.....	
14,400	600	.0063	.....	
9,600	400	.0051	.....	
4,800	200	.0034	.....	
2,400	100	.....	.0022	
4,800	200	.0029	.....	
9,600	400	.0043	.....	
14,400	600	.0055	.....	
19,200	800	.0065	.....	
24,000	1,000	.0073	.....	
48,000	2,000	.0104	.....	
72,000	3,000	.0127	.....	
96,000	4,000	.0150	.....	
120,000	5,000	.0169	.....	
96,000	4,000	.0151	.....	
72,000	3,000	.0130	.....	
48,000	2,000	.0109	.....	
24,000	1,000	.0079	.....	
19,200	800	.0070	.....	
14,400	600	.0061	.....	
9,600	400	.0049	.....	
4,800	200	.0031	.....	
2,400	100	.....	.0021	

Lateral expansion under endwise compression loads.
Transverse gauged length, $5\frac{1}{2}$″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,400	100	0.	0.	Initial load.
48,000	2,000	.0005	.....	
96,000	4,000	.0009	.....	
144,000	6,000	.0013	.....	
96,000	4,000	.0010	.....	
48,000	2,000	.0006	.....	
2,400	100	.....	.0001	
144,000	6,000	.0014	.....	
2,400	100	.....	.0001	
144,000	6,000	.0014	.....	
2,400	100	.....	.0002	Test discontinued.

SOUTHERN MARBLE FROM MARBLE HILL, GEORGIA.

No. 6965.

Length, 24″.03.
Sectional area, 6″.02×4″.02=24.20 square inches.
Weight, 56¾ pounds=168.6 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,420	100	0.	0.	Initial load.
4,840	200	.0003	.....	
9,680	400	.0010	.....	
14,520	600	.0017	.....	
19,360	800	.0023	.....	
24,200	1,000	.0029	.0007	
33,880	1,400	.0040	.....	
43,560	1,800	.0050	.....	
48,400	2,000	.0055	.0009	
58,080	2,400	.0064	.....	
67,760	2,800	.0073	.....	
72,600	3,000	.0077	.....	E=9,090,900 pounds between 1,000 pounds and 3,000 pounds per square inch.
48,400	2,000	.0060	.....	
24,200	1,000	.0040	.....	
2,420	100	.....	.0011	
24,200	1,000	.0038	.....	
48,400	2,000	.0058	.....	
72,600	3,000	.0078	.....	
82,280	3,400	.0085	.....	
91,960	3,800	.0093	.....	
96,800	4,000	.0097	.....	
72,600	3,000	.0080	.....	
48,400	2,000	.0063	.....	
24,200	1,000	.0043	.....	
2,420	100	.....	.0013	
24,200	1,000	.0040	.....	
48,400	2,000	.0061	.....	
72,600	3,000	.0080	.....	
96,800	4,000	.0098	.....	
106,480	4,400	.0105	.....	
116,160	4,800	.0113	.....	
121,000	5,000	.0117	.....	
96,800	4,000	.0101	.....	
72,600	3,000	.0084	.....	
48,400	2,000	.0067	.....	
24,200	1,000	.0046	.....	
2,420	100	.....	.0017	
24,200	1,000	.0042	.....	
48,400	2,000	.0064	.....	
72,600	3,000	.0083	.....	
96,800	4,000	.0101	.....	
121,000	5,000	.0118	.....	
130,680	5,400	.0126	.....	
140,360	5,800	.0133	.....	
145,200	6,000	.0137	.....	
121,000	5,000	.0122	.....	
96,800	4,000	.0105	.....	
72,600	3,000	.0088	.....	
48,400	2,000	.0070	.....	
24,200	1,000	.0049	.....	
2,420	100	.....	.0019	No change in the set after 8 minutes' rest.
24,200	1,000	.0046	.....	
48,400	2,000	.0068	.....	
72,600	3,000	.0087	.....	
96,800	4,000	.0103	.....	
121,000	5,000	.0122	.....	
145,200	6,000	.0138	.....	
154,880	6,400	.0147	.....	
164,560	6,800	.0156	.....	
169,400	7,000	.0160	.....	E=10,810,800 pounds between 5,000 pounds and 7,000 pounds per square inch.
145,200	6,000	.0143	.....	
121,000	5,000	.0127	.....	
96,800	4,000	.0109	.....	

No. 6965—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
72,600	3,000	.0093	.....	
48,400	2,000	.0074	.....	
24,200	1,000	.0053	.....	
2,420	100	.....	.0023	
24,200	1,000	.0049	.....	
48,400	2,000	.0071	.....	
72,600	3,000	.0089	.....	
96,800	4,000	.0107	.....	
121,000	5,000	.0125	.....	
145,200	6,000	.0142	.....	
169,400	7,000	.0161	.....	
145,200	6,000	.0144	.....	
121,000	5,000	.0128	.....	
96,800	4,000	.0110	.....	
72,600	3,000	.0093	.....	
48,400	2,000	.0076	.....	
24,200	1,000	.0054	.....	
2,420	100	.....	.0024	

Lateral expansion under endwise compression loads.
Transverse gauged length $5\frac{1}{2}''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,420	100	0.	0.	Initial load.
24,200	1,000	.0001	.....	
48,400	2,000	.0003	.....	
72,600	3,000	.0005	.....	
96,800	4,000	.0006	.....	
121,000	5,000	.0007	.....	
145,200	6,000	.0009	.....	
169,400	7,000	.0010	.....	
145,200	6,000	.0009	.....	
121,000	5,000	.0008	.....	
96,800	4,000	.0006	.....	
72,600	3,000	.0005	.....	
48,400	2,000	.0004	.....	
24,200	1,000	.0002	.....	
2,420	100	.....	0.	
169,400	7,000	.0011	.....	
2,420	100	.....	0.	
169,400	7,000	.0011	.....	
2,420	100	.....	0.	Test discontinued.

TUCKAHOE MARBLE, FROM TUCKAHOE, N. Y.

No. 6966.

Length, 24″.
Sectional area, 6″.08 × 4″.03=24.5 square inches.
Weight, 60½ pounds=177.8 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,450	100	0.	0.	Initial load.
4,900	200	.0005	.....	
9,800	400	.0013	.....	
14,700	600	.0020	.....	
19,600	800	.0026	.....	
24,500	1,000	.0030	.0005	
34,300	1,400	.0035	.....	
44,100	1,800	.0040	.....	
49,000	2,000	.0043	0.	
58,800	2,400	.0046	.....	
68,600	2,800	.0051	.....	
73,500	3,000	.0054	—.0001	E=13,333,300 pounds between 1,000 pounds and 3,000 pounds per square inch.
83,300	3,400	.0059	.....	
93,100	3,800	.0064	.....	
98,000	4,000	.0067	.....	
73,500	3,000	.0055	.....	
49,000	2,000	.0040	.....	
24,500	1,000	.0021	.....	
2,450	100	.....	—.0001	
24,500	1,000	.0018	.....	
49,000	2,000	.0038	.....	
73,500	3,000	.0053	.....	
98,000	4,000	.0066	.....	
107,800	4,400	.0072	.....	
117,600	4,800	.0077	.....	
122,500	5,000	.0080	0.	
132,300	5,400	.0085	.....	
142,100	5,800	.0089	.....	
147,000	6,000	.0092	.....	
122,500	5,000	.0080	.....	
98,000	4,000	.0066	.....	
73,500	3,000	.0053	.....	
49,000	2,000	.0038	.....	
24,500	1,000	.0019	.....	
2,450	100	.....	0.	
24,500	1,000	.0016	.....	
49,000	2,000	.0045	.....	
73,500	3,000	.0050	.....	
98,000	4,000	.0065	.....	
122,500	5,000	.0079	.....	
147,000	6,000	.0091	.....	
156,800	6,400	.0098	.....	
166,600	6,800	.0103	.....	
171,500	7,000	.0106	.0001	
181,300	7,400	.0110	.....	
191,100	7,800	.0116	.....	
196,000	8,000	.0119	.0001	
205,800	8,400	.0124	.....	
215,600	8,800	.0130	.....	
220,500	9,000	.0134	.0002	
230,300	9,400	.0139	.....	
240,100	9,800	.0144	.....	
245,000	10,000	.0147	.....	E=15,384,600 pounds between 8,000 pounds and 10,000 pounds per square inch.
220,500	9,000	.0135	.....	
196,000	8,000	.0122	.....	
171,500	7,000	.0109	.....	
147,000	6,000	.0095	.....	
122,500	5,000	.0082	.....	
98,000	4,000	.0067	.....	
73,500	3,000	.0053	.....	
49,000	2,000	.0037	.....	
24,500	1,000	.0018	.....	
2,450	100	.....	.0003	

No. 6966—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
24,500	1,000	.0018	.....	
49,000	2,000	.0036	.....	
73,500	3,000	.0051	.....	
98,000	4,000	.0065	.....	
122,500	5,000	.0080	.....	
147,000	6,000	.0093	.....	
171,500	7,000	.0107	.....	
196,000	8,000	.0120	.....	
220,500	9,000	.0134	.....	
245,000	10,000	.0147	.0004	

Lateral expansion under end wise compression loads.
Transverse gauged length, $5\frac{1}{2}''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,450	100	0.	0.	Initial load.
24,500	1,000	0.	.....	
49,000	2,000	.0001	.....	
73,500	3,000	.0002	.....	
98,000	4,000	.0003	.....	
122,500	5,000	.0004	.....	
147,000	6,000	.0005	.....	
171,500	7,000	.0006	.....	
196,000	8,000	.0007	.....	
220,500	9,000	.0008	.....	
245,000	10,000	.....	.....	Piece of stone $11'' \times 4'' \times \frac{3}{8}''$ detached from under side of specimen; test discontinued.

TUCKAHOE MARBLE, FROM TUCKAHOE, N. Y.

No. 6971.

Length, 24″.05.
Sectional area, 6″.04 × 4″.02=24.28 square inches.
Weight, 60¼ pounds=178.2 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,428	100	0.	0.	Initial load.
4,856	200	.0002	.....	
9,712	400	.0007	.....	
14,568	600	.0015	.....	
19,424	800	.0020	.....	
24,280	1,000	.0025	.0003	
48,560	2,000	.0041	.0003	
72,840	3,000	.0053	.0002	E=13,793,100 pounds between 1,000 pounds and 3,000 pounds per square inch.
97,120	4,000	.0065	.0002	
121,400	5,000	.0077	.0002	
145,680	6,000	.0088	.....	E=18,181,800 pounds between 5,000 pounds and 6,000 pounds per square inch.
121,400	5,000	.0076	.....	
97,120	4,000	.0062	.....	
72,840	3,000	.0049	.....	
48,560	2,000	.0034	.....	
24,280	1,000	.0019	.....	
19,424	800	.0015	.....	
14,568	600	.0011	.....	
9,712	400	.0007	.....	
4,856	200	.0003	.....	
2,428	100	.....	.0002	
4,856	200	.0003	.....	
9,712	400	.0004	.....	
14,568	600	.0007	.....	
19,424	800	.0011	.....	
24,280	1,000	.0015	.0002	
48,560	2,000	.0036	.....	
72,840	3,000	.0047	.....	
97,120	4,000	.0060	.....	
121,400	5,000	.0074	.....	
145,680	6,000	.0088	.....	
121,400	5,000	.0074	.....	
97,120	4,000	.0061	.....	
72,840	3,000	.0048	.....	
48,560	2,000	.0034	.....	
24,280	1,000	.0018	.....	
19,424	800	.0014	.....	
14,568	600	.0010	.....	
9,712	400	.0006	.....	
4,856	200	.0003	.....	
2,428	100	.....	.0002	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5½″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,428	100	0.	0.	Initial load.
48,560	2,000	.0001	.....	
97,120	4,000	.0003	.....	
145,680	6,000	.0004	.....	
97,120	4,000	.0003	.....	
48,560	2,000	.0001	.....	
2,428	100	.....	0.	
145,680	6,000	.0004	.....	
2,428	100	.....	0.	Test discontinued.

LIMESTONE FROM DR. A. G. LOVELL, MOUNT VERNON, KY.

No. 6957.

Marks, I I.
Length, 24″.10.
Sectional area, 6″.05 × 4″.12=24.93 square inches.
Weight, 48¾ pounds=140.2 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,493	100	0.	0.	Initial load.
4,986	200	.0007	.....	
9,972	400	.0023	.....	
14,958	600	.0038	.....	
19,944	800	.0053	.....	
24,930	1,000	.0068	.0013	
29,916	1,200	.0083	.....	
34,902	1,400	.0096	.....	
39,888	1,600	.0111	.....	
44,874	1,800	.0126	.....	
49,860	2,000	.0141	.....	E=3,174,600 pounds between 1,000 pounds and 2,000 pounds per square inch.
24,930	1,000	.0094	.....	
2,493	100	.....	.0023	
24,930	1,000	.0084	.....	
49,860	2,000	.0143	.....	
54,846	2,200	.0155	.....	
59,832	2,400	.0167	.....	
64,818	2,600	.0180	.....	
69,804	2,800	.0193	.....	
74,790	3,000	.0204	.....	E=3,636,300 pounds between 2,000 pounds and 3,000 pounds per square inch.
59,832	2,400	.0182	.....	
49,860	2,000	.0164	.....	
34,902	1,400	.0136	.....	
24,930	1,000	.0112	.....	
9,972	400	.0067	.....	
2,493	100	.....	.0031	
9,972	400	.0053	.....	
24,930	1,000	.0095	.....	
34,902	1,400	.0121	.....	
49,860	2,000	.0154	.....	
59,832	2,400	.0176	.....	
49,860	2,000	.0160	.....	
34,902	1,400	.0132	.....	
24,930	1,000	.0110	.....	
9,972	400	.0067	.....	
2,493	100	.....	.0032	
9,972	400	.0053	.....	
24,930	1,000	.0096	.....	
34,902	1,400	.0121	.....	
49,860	2,000	.0154	.....	
34,902	1,400	.0129	.....	
24,930	1,000	.0108	.....	
9,972	400	.0065	.....	
2,493	100	.....	.0032	
9,972	400	.0054	.....	
24,930	1,000	.0097	.....	
34,902	1,400	.0121	.....	
24,930	1,000	.0103	.....	
9,972	400	.0064	.....	
2,493	100	.....	.0032	
9,972	400	.0055	.....	
24,930	1,000	.0098	.....	
9,972	400	.0061	.....	
2,493	100	.....	.0032	
9,972	400	.0055	.....	
2,493	100	.....	.0032	
49,860	2,000	.0153	0032	
49,860	2,000	.0153	.0033	
49,860	2,000	.0154	.0033	
49,860	2,000	.0154	.0034	
49,860	2,000	.0155	.0034	

No. 6957—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
49,860	2,000	.0156	.0034	
49,860	2,000	.0156	.0035	
49,860	2,000	.0156	.0035	
49,860	2,000	.0157	.0035	
49,860	2,000	.0156+	.....	
34,902	1,400	.0131	.....	
24,930	1,000	.0111	.....	
9,972	400	.0068	.....	
2,493	100	.....	.0036	
9,972	400	.0056	.....	
24,930	1,000	.0101	.....	
34,902	1,400	.0125	.....	
49,860	2,000	.0157	.....	
34,902	1,400	.0132	.....	
24,930	1,000	.0111	.....	
9,972	400	.0069	.....	
2,493	100	.....	.0037	Test discontinued.

LIMESTONE FROM DR. A. G. LOVELL, MOUNT VERNON, KY.

No. 6958.

Marks, I I I.
Length, 24″.01.
Sectional area, 6″.05 × 4″.03=24.38 square inches.
Weight, 46¾ pounds=138 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,438	100	0.	0.	Initial load.
4,876	200	.0010	.....	
9,752	400	.0027	.....	
14,628	600	.0044	.....	
19,504	800	.0059	.....	
24,380	1,000	.0075	.0011	
29,256	1,200	.0089	.....	
34,132	1,400	.0103	.....	
39,008	1,600	.0117	.....	
43,884	1,800	.0131	.....	
48,760	2,000	.0145	.....	E=3,225,800 pounds between 1,000 pounds and 2,000 pounds per square inch.
24,380	1,000	.0090	.....	
2,438	100	.....	.0019	
24,380	1,000	.0081	.....	
48,760	2,000	.0146	.....	
53,636	2,200	.0157	.....	
58,512	2,400	.0171	.....	
63,388	2,600	.0186	.....	
68,264	2,800	.0199	.....	
73,140	3,000	.0214	.....	E=3,076,900 pounds between 2,000 pounds and 3,000 pounds per square inch.
58,512	2,400	.0184	.....	
48,760	2,000	.0161	.....	
34,132	1,400	.0126	.....	
24,380	1,000	.0101	.....	
9,752	400	.0055	.....	
2,438	100	.....	.0023	
9,752	400	.0046	.....	
24,380	1,000	.0088	.....	
34,132	1,400	.0113	.....	
48,760	2,000	.0158	.....	
34,132	1,400	.0120	.....	
24,380	1,000	.0096	.....	
9,752	400	.0053	.....	
2,438	100	.....	.0024	

Observations on the lateral expansion under endwise compressive loads.

Transverse gauged length, 5½″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,438	100	0.	0.	Initial load.
24,380	1,000	.0004	.....	
48,760	2,000	.0009	.....	
73,140	3,000	.0014	.....	
2,438	100	.....	.0001	
73,140	3,000	.0014	.....	
2,438	100	.....	.0001	
73,140	3,000	.0015	.....	
2,438	100	.....	.0001	
73,140	3,000	.0015	.....	
2,438	100	.....	.0002	
73,140	3,000	.0015	.....	
2,438	100	.....	.0002	Test discontinued.

North River Bluestone.

No. 6519.

Length, 24″.
Sectional area, 6″.06×4″.03=24.4 square inches.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,440	100	0.	0.	Initial load.
24,400	1,000	.0036	.....	
48,800	2,000	.0077	.....	E=5,268,800 pounds between 100 pounds and 5,000 pounds per square inch.
73,200	3,000	.0122	.....	
97,600	4,000	.0165	.....	
122,000	5,000	.0208	.0022	
146,400	6,000	.0247	.....	
170,800	7,000	.0287	.....	E=5,681,800 pounds between 5,000 pounds and 10,000 pounds per square inch.
195,200	8,000	.0324	.....	
219,600	9,000	.0360	.....	
244,000	10,000	.0394	.0032	
559,900	22,947	.....	.....	Ultimate strength.

SANDSTONE FROM COOPER SANDSTONE QUARRY, DOUGLAS COUNTY, OREG.

No. 6972.

Length, 24″.11.
Sectional area, 6″.10×4″.21=25.68 square inches.
Weight, 57¼ pounds=159.8 pounds per cubic foot.
Gauged length, 29″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,568	100	0.	0.	Initial load.
5,136	200	.0009	.....	
10,272	400	.0035	.....	
15,408	600	.0055	.....	
20,544	800	.0076	.....	
25,680	1,000	.0098	.0028	
25,680	1,000	.0104	.0035	
30,816	1,200	.0120	.....	
35,952	1,400	.0138	.....	
41,088	1,600	.0156	.....	
46,224	1,800	.0174	.....	
51,360	2,000	.0190	.....	E=2,816,900 pounds between 1,000 pounds and 2,000 pounds per square inch.
25,680	1,000	.0138	.....	
2,568	100	.....	.0050	
25,680	1,000	.0120	.....	
51,360	2,000	.0192	.....	
56,496	2,200	.0206	.....	
61,632	2,400	.0221	.....	
66,768	2,600	.0233	.....	
71,904	2,800	.0251	.....	
77,040	3,000	.0266	.....	E=3,225,800 pounds between 2,000 pounds and 3,000 pounds per square inch.
51,360	2,000	.0222	.....	
25,680	1,000	.0160	.....	
2,568	100	.....	.0004	
2,568	100	.....	.0059	After resting 1 hour.
25,680	1,000	.0131	.....	
51,360	2,000	.0204	.....	
77,040	3,000	.0268	.....	
51,360	2,000	.0224	.....	
25,680	1,000	.0161	.....	
2,568	100	.....	.0066	
25,680	1,000	.0138	.....	
51,360	2,000	.0210	.....	
77,040	3,000	.0269	.....	
51,360	2,000	.0224	.....	
25,680	1,000	.0163	.....	
2,568	100	.....	.0068	

Lateral expansion under endwise compression loads.
Transverse gauged length, 5½″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,568	100	0.	0.	Initial load.
25,680	1,000	.0001	.....	
51,360	2,000	.0003	.....	
77,040	3,000	.0005	.....	
51,360	2,000	.0003	.....	
25,680	1,000	.0002	.....	
2,568	100	.....	0.	
77,040	3,000	.0005	.....	
2,568	100	.....	0.	Test discontinued.

MAYNARD SANDSTONE FROM EAST LONGMEADOW, MASS.

No. 6963.

Length, 24″.03.
Sectional area, 6″.04×3″.99=24.1 square inches.
Weight, 44¾ pounds=133.5 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,410	100	0.	0.	Initial load.
4,820	200	.0049	.....	
9,640	400	.0087	.....	
14,460	600	.0132	.....	
19,280	800	.0164	.....	
24,100	1,000	.0198	.0069	
28,920	1,200	.0230	.....	
33,740	1,400	.0256	.....	
38,560	1,600	.0282	.....	
43,380	1,800	.0306	.....	
48,200	2,000	.0328	.....	E=1,941,700 pounds between 1,000 pounds and 2,000 pounds per square inch.
24,100	1,000	.0247	.....	
2,410	100	.....	.0096	
24,100	1,000	.0227	.....	
48,200	2,000	.0333	.....	
53,020	2,200	.0353	.....	
57,840	2,400	.0376	.....	
62,660	2,600	.0398	.....	
67,480	2,800	.0419	.....	
72,300	3,000	.0443	.....	
48,200	2,000	.0373	.....	
24,100	1,000	.0278	.....	
2,410	100	.....	.0116	
24,100	1,000	.0248	.....	
48,200	2,000	.0353	.....	
72,300	3,000	.0447	.....	
48,200	2,000	.0378	.....	
24,100	1,000	.0281	.....	
2,410	100	.....	.0120	
24,100	1,000	.0252	.....	
48,200	2,000	.0357	.....	
72,300	3,000	.0449	.....	
77,120	3,200	.0469	.....	
81,940	3,400	.0489	.....	
86,760	3,600	.0511	.....	
91,580	3,800	.0531	.....	
96,400	4,000	.0554	.....	E=2,127,600 pounds between 3,000 pounds and 4,000 pounds per inch.
72,300	3,000	.0489	.....	
48,200	2,000	.0410	.....	
24,100	1,000	.0308	.....	
2,410	100	.....	.0133	
24,100	1,000	.0271	.....	
48,200	2,000	.0378	.....	
72,300	3,000	.0470	.....	
48,200	2,000	.0397	.....	
24,100	1,000	.0300	.....	
2,410	100	.....	.0136	

Lateral expansion under endwise compression loads.
Transverse gauged length, $5\frac{1}{2}''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,410	100	0.	0.	Initial load.
24,100	1,000	.0007	.....	
48,200	2,000	.0017	.....	
72,300	3,000	.0028	.....	
96,400	4,000	.0042	.....	
72,300	3,000	.0037	.....	
48,200	2,000	.0029	.....	
24,100	1,000	.0020	.....	
2,410	100	.....	.0003	
24,100	1,000	.0010	.....	
48,200	2,000	.0021	.....	
72,300	3,000	.0031	.....	
96,400	4,000	.0043	.....	
72,300	3,000	.0038	.....	
48,200	2,000	.0031	.....	
24,100	1,000	.0022	.....	
2,410	100	.....	.0005	
96,400	4,000	.0044	.....	
2,410	100	.....	.0006	Test discontinued.

KIBBE SANDSTONE FROM EAST LONGMEADOW, MASS.

No. 6964.

Length, 24″.02.
Sectional area, 6″.02×4″.01=24.14 square inches.
Weight, 44¾ pounds=133.4 pounds per cubic foot.
Gauged length, 20″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,414	100	0.	0.	Initial load.
4,828	200	.0049	.....	
9,656	400	.0123	.....	
14,484	600	.0178	.....	
19,312	800	.0218	.....	
24,140	1,000	.0254	.0100	
28,968	1,200	.0287	.....	
33,796	1,400	.0314	.....	
38,624	1,600	.0339	.....	
43,452	1,800	.0363	.....	
48,280	2,000	.0387	.....	E=1,834,000 pounds between 1,000 pounds and 2,000 pounds per square inch.
24,140	1,000	.0295	.....	
2,414	100	.....	.0124	
24,140	1,000	.0276	.....	
48,280	2,000	.0388	.....	
53,108	2,200	.0408	.....	
57,936	2,400	.0430	.....	
62,764	2,600	.0451	.....	
67,592	2,800	.0471	.....	
72,420	3,000	.0489	.....	
48,280	2,000	.0414	.....	
24,140	1,000	.0315	.....	
2,414	100	.....	.0138	
24,140	1,000	.0289	.....	
48,280	2,000	.0398	.....	
72,420	3,000	.0493	.....	
77,248	3,200	.0513	.....	
82,076	3,400	.0532	.....	
86,904	3,600	.0551	.0149	
91,732	3,800	.0572	.....	
96,560	4,000	.0591	.....	
72,420	3,000	.0523	.....	
48,280	2,000	.0440	.....	
24,140	1,000	.0336	.....	
2,414	100	.....	.0175	
24,140	1,000	.0304	.....	
48,280	2,000	.0412	.....	
72,420	3,000	.0506	.....	
96,560	4,000	.0591	.....	
101,388	4,200	.0613	.....	
106,216	4,400	.0630	.....	
111,044	4,600	.0650	.....	
115,872	4,800	.0667	.....	
120,700	5,000	.0687	.....	E=2,298,800 pounds between 4,000 pounds and 5,000 pounds per square inch.
96,560	4,000	.0623	.....	
72,420	3,000	.0548	.....	
48,280	2,000	.0462	.....	
24,140	1,000	.0352	.....	
2,414	100	.....	.0166	
24,140	1,000	.0314	.....	
48,280	2,000	.0425	.....	
72,420	3,000	.0520	.....	
96,560	4,000	.0606	.....	
120,700	5,000	.0691	.....	
96,560	4,000	.0626	.....	
72,420	3,000	.0552	.....	
48,280	2,000	.0467	.....	
24,140	1,000	.0357	.....	
2,414	100	.....	.0172 .0169	After 10 minutes' rest.

Lateral expansion under endwise compression loads.
Transverse gauged length, $5\frac{1}{2}''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,414	100	0.	0.	Initial load.
24,140	1,000	.0005	.....	
48,280	2,000	.0014	.....	
72,420	3,000	.0024	.....	
96,560	4,000	.0033	.....	
120,700	5,000	.0045	.....	
96,560	4,000	.0040	.....	
72,420	3,000	.0034	.....	
48,280	2,000	.0027	.....	
24,140	1,000	.0016	.....	
2,414	100	.....	.0003	No change in set observed after 10 minutes' rest.
24,140	1,000	.0007	.....	
48,280	2,000	.0015	.....	
72,420	3,000	.0025	.....	
96,560	4,000	.0034	.....	
120,700	5,000	.0046	.....	
96,560	4,000	.0041	.....	
72,420	3,000	.0035	.....	
48,280	2,000	.0028	.....	
24,140	1,000	.0018	.....	
2,414	100	.....	.0003	Test discontinued.

WORCESTER BROWN SANDSTONE FROM EAST LONGMEADOW, MASS.

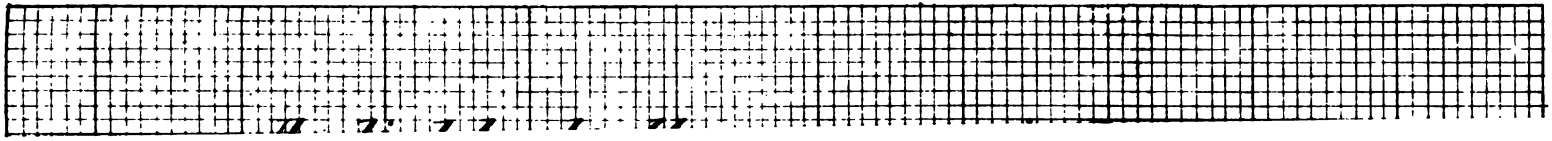
No. 6962.

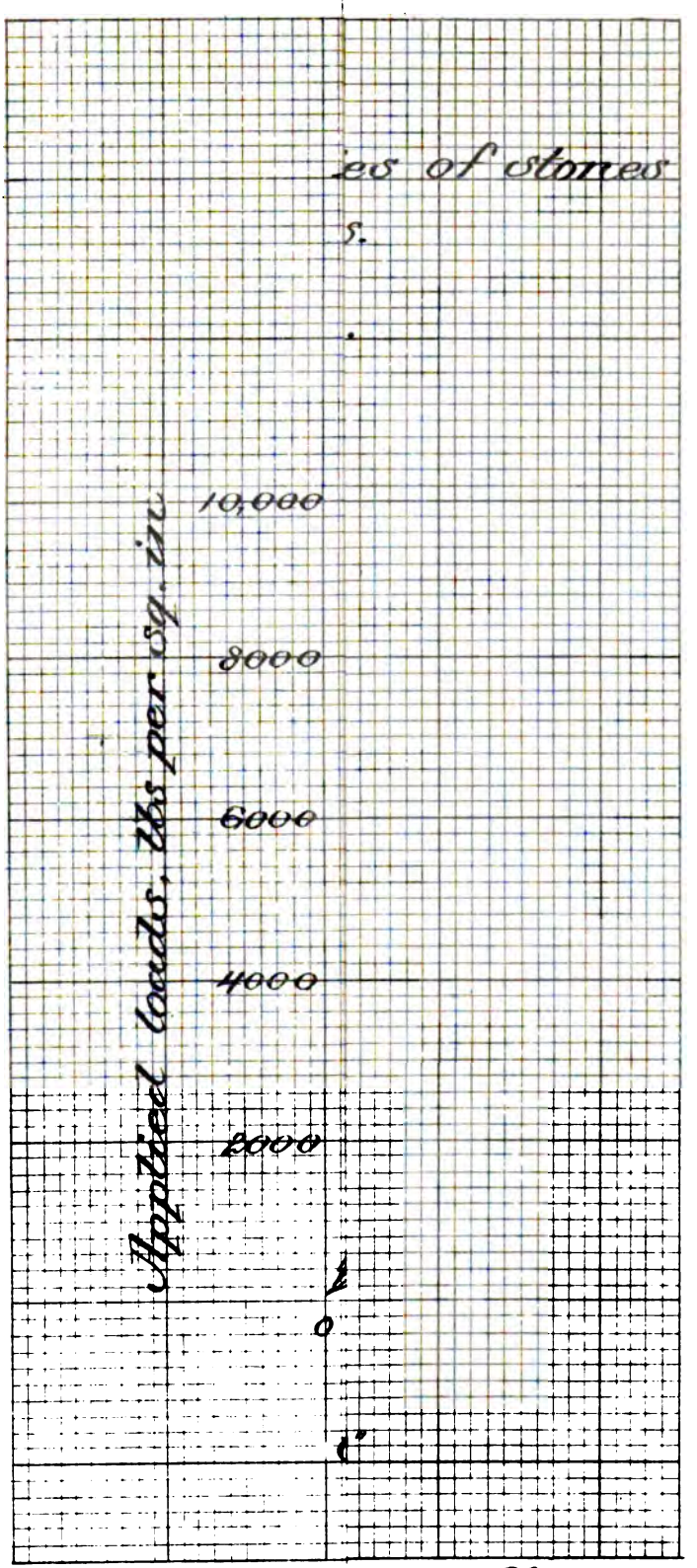
Length, 24″.
Sectional area, 6″.01 × 3″.99 = 23.98 square inches.
Weight, 45½ pounds = 136.6 pounds per cubic foot.
Gauged length, 20″.

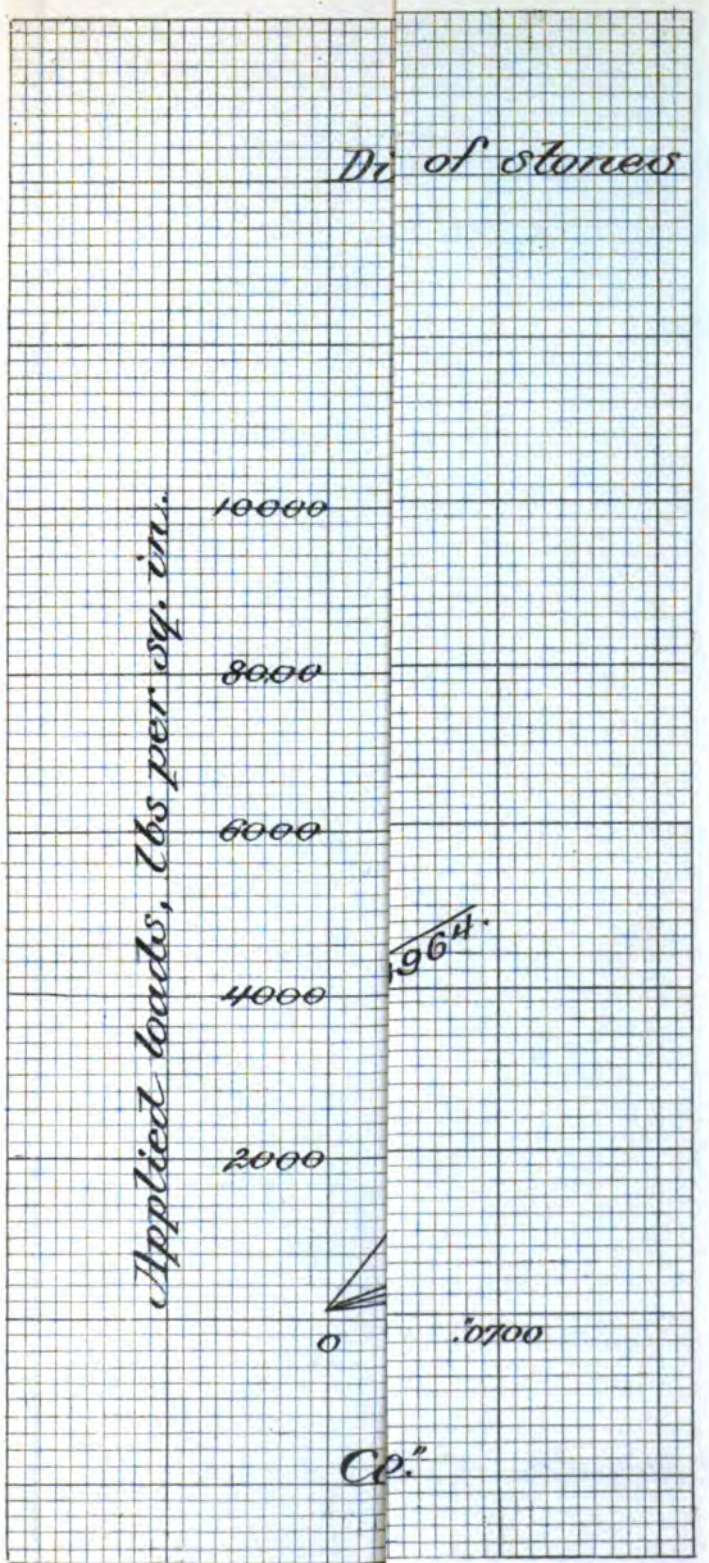
Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,398	100	0.	0.	Initial load.
4,796	200	.0020	.....	
9,592	400	.0055	.....	
14,388	600	.0085	.....	
19,184	800	.0111	.....	
23,980	1,000	.0135	.0040	
28,776	1,200	.0155	.....	
33,572	1,400	.0176	.....	
38,368	1,600	.0193	.....	
43,164	1,800	.0211	.....	
47,960	2,000	.0228	.0051	E = 2,439,000 pounds between 1,000 pounds and 2,000 pounds per square inch.
52,756	2,200	.0248	.....	
57,552	2,400	.0265	.....	
62,348	2,600	.0282	.....	
67,144	2,800	.0297	.....	
71,940	3,000	.0313	.....	
47,960	2,000	.0256	.....	
23,980	1,000	.0180	.0062	
23,980	1,000	.0158	.....	
47,960	2,000	.0242	.....	
71,940	3,000	.0315	.....	
47,960	2,000	.0257	.....	
23,980	1,000	.0182	.0065	
23,980	1,000	.0158	.....	
47,960	2,000	.0243	.....	
71,940	3,000	.0317	.....	
76,736	3,200	.0331	.....	
81,532	3,400	.0346	.....	
86,328	3,600	.0363	.....	
91,124	3,800	.0379	.....	
95,920	4,000	.0394	.....	E = 2,898,500 pounds between 3,000 pounds and 4,000 pounds per square inch.
71,940	3,000	.0340	.....	
47,960	2,000	.0277	.....	
23,980	1,000	.0196	.0074	
23,980	1,000	.0170	.....	
47,960	2,000	.0253	.....	
71,940	3,000	.0328	.....	
95,920	4,000	.0397	.....	
71,940	3,000	.0344	.....	
47,960	2,000	.0279	.....	
23,980	1,000	.0198	.0077 .0074	After 10 minutes' rest.

Lateral expansion under endwise compression loads.
Transverse gauged length, $5\frac{1}{2}''$.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Lateral expansion.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
2,398	100	0.	0.	Initial load.
23,980	1,000	.0004	.....	
47,960	2,000	.0009	.....	
71,940	3,000	.0014	.....	
95,920	4,000	.0021	.....	
71,940	3,000	.0018	.....	
47,960	2,000	.0014	.....	
23,980	1,000	.0008	.....	
11,990	500	.0004	.0002	
23,980	1,000	.0005	.....	
47,960	2,000	.0009	.....	
71,940	3,000	.0015	.....	
95,920	4,000	.0022	.....	
71,940	3,000	.0019	.....	
47,960	2,000	.0014	.....	
23,980	1,000	.0009	.....	
11,990	500	.0005	.0002	
11,990	500	.0004	.....	
23,980	1,000	.0005	.....	
11,990	500	.0004	.0002	No change in set after 10 minutes' rest.
95,920	4,000	.0023	.0002	Test discontinued.




es of Stones
s.
10,000
8000
6000
4000
2000
Applied loads, lbs per sq. in.
0


Di of stones
Applied loads, lbs per sq. in.
10000
8000
6000
4000
2000
0
.0700
Co."

H Ex 92 53 3

NATURAL STONES.

TRANSVERSE TESTS.

NATURAL STONES.

TRANSVERSE TESTS.

Milford Pink Granite from Milford Pink Granite Company, Boston, Mass.

No. of test.	Marks.	Distance between end supports.	Dimensions.		Ultimate strength.	
			Breadth.	Depth.	Total.	Modulus of rupture, R.
		Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*
203	.....	19	4.03	6.03	9,020	1,745

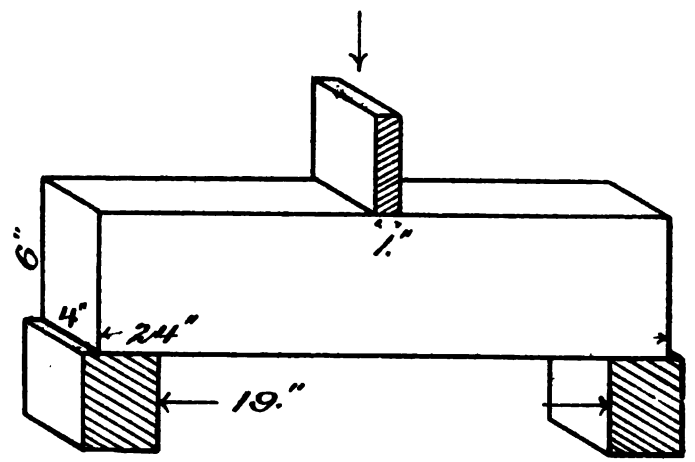
Granite from Pigeon Hill Granite Company, Rockport, Mass.

No. of test.	Marks.	Distance between end supports.	Dimensions.		Ultimate strength.	
			Breadth.	Depth.	Total.	Modulus of rupture, R.
		Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*
204	.....	19	4.03	6.02	12,320	2,404
205	.....	19	4.01	6.06	12,480	2,416

Tests of Stones.

Form of specimens,

transverse tests.



H Ex 92 53 3

NATURAL STONES.

SHEARING TESTS.

NATURAL STONES.

SHEARING TESTS.

Stones from Charles River Stone Company, Boston, Mass.

No. of test.	Description.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
					Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
240	Milford granite, Milford, Mass.	4.02 × 6.03 × 2	48.48	24,800	108,400	2,236	One.
241	.....do.....	4.02 × 6.01 × 2	48.32	27,300	138,800	2,872	Two.
242	Brandford granite, Brandford, Conn.	4.04 × 6.01 × 2	48.56	18,900	93,500	1,925	One.
243	.....do.....	4.03 × 6.01 × 2	48.44	19,600	84,400	1,742	One.
244	Troy granite, Troy, N. H..	4.03 × 6.00 × 2	48.36	29,900	107,900	2,231	One.
245	.....do.....	4.06 × 6.02 × 2	48.88	34,400	107,400	2,197	One.
246	Maynard stone, East Longmeadow, Mass.	3.99 × 6.01 × 2	47.96	25,800	53,700	1,120	One.
247	.....do.....	4.02 × 6.00 × 2	48.24	19,900	62,100	1,287	Two.
248	Worcester stone, East Longmeadow, Mass.	4.00 × 6.00 × 2	48.00	22,900	66,400	1,383	Two.
249	.....do.....	4.00 × 5.98 × 2	47.84	26,200	52,700	1,102	Two.
250	Kibbe stone, East Longmeadow, Mass.	4.00 × 6.00 × 2	48.00	25,100	47,600	992	Two.
251	.....do.....	4.00 × 6.00 × 2	48.00	29,400	62,800	1,308	One.
252	Southern marble, Marble Hill, Ga.	4.02 × 6.00 × 2	48.24	26,700	56,100	1,163	One.
253	.....do.....	4.02 × 6.00 × 2	48.24	30,300	72,400	1,501	One.
254	Tuckahoe marble, Tuckahoe, N. Y.	4.02 × 6.01 × 2	48.32	29,850	75,100	1,554	One.
255	.....do.....	4.02 × 6.00 × 2	48.24	35,700	68,800	1,426	One.

Milford Pink Granite from Milford Pink Granite Company, Boston, Mass.

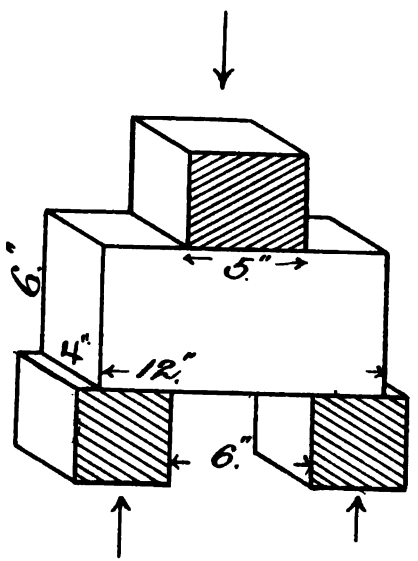
No. of test.	Marks.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
					Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
262	.....	6.01 × 4.02 × 2	48.32	38,300	88,200	1,825	One.

Granite from Pigeon Hill Granite Company, Rockport, Mass.

No. of test.	Marks.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
					Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
263	.....	6.05 × 4.00 × 2	48.40	45,400	99,100	2,047	
264	.....	6.01 × 4.00 × 2	48.08	38,600	50,600	1,052	

Tests of Stones.

Form of specimens, shearing tests.



H Ex 92 53 3

Marble from Georgia Marble Company, Tate, Ga.

No. of test.	Description.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
					Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
256	Creole Quarry ...	3.98×6.00×2	47.76	22,700	65,400	1,369	One.
257	Cherokee Quarry	4.00×6.01×2	48.08	21,100	59,500	1,237	One.
258	Etowah Quarry..	4.00×5.99×2	47.92	25,400	67,600	1,411	One.
259	Kennesaw Quarry	4.00×5.98×2	47.84	21,300	59,400	1,242	One.

Limestone from Dr. A. G. Lovell, Mount Vernon, Ky.

No. of test.	Description.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
					Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
237	1 Spring Ledge .	4.10×6.00×2	49.20	25,800	99,200	2,016	Two.
238	11	4.00×6.02×2	48.16	25,100	82,400	1,711	One.
239	111	3.98×5.95×2	47.36	15,600	65,800	1,389	Two.

Sandstone from the Cooper Sandstone Quarry, Douglas County, Oreg.

No. of test.	Marks.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
					Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
260	.....	3.99×6.31×2	49.00	22,500	89,700	1,831	Two.

Sandstone from the Chuckanut Quarries, Chuckanut or Whatcom, Wash.

No. of test.	Marks.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
					Total.	Per square inch.	
		Inches.	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
261	.....	4.15×6.31×2	52.37	27,000	70,800	1,352	Two.

CHEMICAL ANALYSES OF STONES, BRICKS, AND CEMENT.

The material for analyses was taken from the following tested specimens:

Description.	Compression test number.	Page.
Granite, Troy, N. H.	6913	.....
Limestone, Mount Vernon, Ky.	6905	.....
Calcite, World's Fair material from Idaho	6680	.....
Sandstone, Cooper Quarry, Oregon	6940	.....
Sandstone, Chuckanut Quarries, Washington	7179	.....
Sandstone, Olympia Quarry, Washington	7176	.....
Sandstone, Maynard Quarry, Massachusetts	6915	.....
Sandstone, Lem Creek, World's Fair material from South Dakota	6868	.....
Lava stone, World's Fair material from Colorado	6656	.....
World's Fair material:		
Shale from Arkansas	6654	.....
Brick from Denny Clay Company, Washington	6534	.....
Brick from Peter Becker, Minnesota	6598	.....
Brick, red, from Minnesota		.....
Brick, Swedish, from Sweden	6574	.....
Brick, Swedish fire, from Sweden	6587	.....
Brick, Japanese fire, from Japan	6634	.....
Cement, Swedish, from the Skånska Cement-Aktiebolaget, Malmö, Sweden	(*)	.....

* Mechanical tests not yet made.

CHEMICAL ANALYSES OF NATURAL STONES, BRICKS, AND CEMENT.

Description.	SiO_2	Fe_2O_3	Al_2O_3	CaO	MgO	Na_2O	K_2O	SO_3	P_2O_5	TiO_2	CO_2	MnO	Loss on ignition.	Loss.
Granite, Troy, N H	71.26	2.24	16.98	1.91	Trace.	3.09	4.43	.....	.....	.....	.....	0.02	.....	.....
Limestone, Kentucky, Mount Vernon Quarry	14.52	0.39	1.02	27.40	16.87	.....	.....	0.05	.....	.....	39.70	.....	.....	0.05
Calcite	.60	.22	.....	51.40	3.54	.....	.....	.10	.....	.....	44.22	.....	.....	.....
Sandstone:														
Cooper Quarry, Douglas County, Oreg	65.36	5.20	14.40	4.38	2.11	.....	.....	.....	.....	3.91	.....	.08	4.56	.....
Chuckanut Quarries, Washington	60.20	6.90	25.08	3.20	2.19	.....	.....	.....	.....	1.40	.....	.08	.95	.....
Olympia Quarry, Washington	57.11	8.54	19.65	5.79	2.24	.....	.....	.....	.....	1.04	.....	.10	5.58	.....
Maynard Quarry, East Longmeadow, Mass	79.51	2.51	8.54	2.70	Trace.	1.85	3.41	.....	.....	.....	.....	.....	.....	1.48
Lem Creek Quarry, South Dakota	82.51	1.04	10.40	None.	Trace.	.....	.....	.....	.....	.....	.....	.....	.....	.05
Lava stone, Denver, Colo	78.85	1.35	19.67	.15	Trace.	.....	.....	.....	.....	.....	.....	.....	.....	.....
Shale, Batesville, Ark	1.50	.52	.....	54.50	Trace.	.....	.....	.14	.....	.....	43.07	.....	.....	.27
Bricks:														
Building, Denny Clay Company, Seattle, Wash.	85.60	1.55	12.10	.71	0.00	.....	.....	.....	.....	.....	.....	.....	.....	.04
Buff, Minnesota, Peter Becker	64.62	4.70	12.35	12.63	5.24	.....	.....	.....	.....	.....	.....	.43	.....	.03
Red, from Minnesota	80.30	5.58	10.67	3.20	.18	.....	.....	.....	.....	.....	.....	.....	.....	.07
Swedish	76.05	4.20	19.00	.61	.12	.....	.....	.....	.....	.....	.....	.....	.....	.02
Fire bricks:														
Swedish	65.24	6.70	26.60	1.00	None.	.....	.....	.....	.....	.....	.....	.40	.....	.06
Japanese	81.74	6.60	11.05	.56	None.	.....	.....	.....	.....	.....	.....	.....	.....	.05
Cement from Sweden	22.40	1.80	8.20	59.74	3.94	.....	.....	1.54	.....	.....	2.34	.....	.....	.04

Tabulation of results of compression, transverse, and shearing tests and coefficients of expansion in water.

Name of stone.	No. of test.	Compressive strength per square inch.	Transverse strength, maximum fiber stress.	Shearing strength per square inch.	Weight per cubic foot.	Compressive moduli of elasticity.		Ratio of lateral expansion to longitudinal compression.	Coefficient of expansion in water.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		
Brandford granite, Connecticut	6911	15,560							
Do	6912	15,854							
Do	6960				162	8,333,300	9,090,900	$\frac{1}{4}$	.00000398
Do	242			1,925					
Do	243			1,742					
Milford granite, Massachusetts	6908	25,451							
Do	6909	19,258							
Do	6910	25,738							
Do	6959				162.5	5,633,800	7,843,100	$\frac{1}{3.5}$	.00000418
Do	6989	24,644				7,692,300	9,523,800		
Do	240			2,236					
Do	241			2,872					
Milford granite, Massachusetts (second specimen)									.00000415
Troy granite, New Hampshire	6913	28,768							
Do	6914	23,580							
Do	6961				164.7	4,545,400	7,692,300	$\frac{1}{3.1}$	.00000337
Do	244			2,231					
Do	245			2,197					
Milford pink granite, Massachusetts	6873	22,162							
Do	6874	19,047							
Do	6875	15,756							
Do	6877				161.9	5,128,000	7,272,700		
Do	202			1,825					
Do	203		1,745						
Pigeon Hill granite, Massachusetts	6870	17,772							
Do	6871	20,716							
Do	6872	20,522							
Do	6876				161.5	6,666,700	9,523,800		
Do	263			2,047					
Do	264			1,052					
Do	204		2,404						
Do	205		2,416						
Creole marble, Georgia	6926	11,420							
Do	6927	15,512							

Do	6967				170	6,806,500	9,090,900	$\frac{1}{2.7}$	
Do	256			1,369					
Cherokee marble, Georgia	6928	13,415							
Do	6929	11,822							
Do	6968				167.8	9,000,000	11,764,700	$\frac{1}{2.7}$	.00000441
Do	257			1,237					
Etowah marble, Georgia	6930	14,217							
Do	6931	13,888							
Do	6969				169.8	7,843,100	9,756,100	$\frac{1}{2.8}$	
Do	258			1,411					
Kennesaw marble, Georgia	6932	8,354							
Do	6933	10,771							
Do	6970				168.1	7,547,100	8,888,800	$\frac{1}{2.9}$	
Do	259			1,242					
Lee marble, Massachusetts									.00000454
Marble Hill marble, Georgia	6921	11,532							
Do	6922	11,478							
Do	6965				168.6	9,090,900	10,810,800	$\frac{1}{2.4}$	.00000202
Do	252			1,163					
Do	253			1,501					
Do									.00000185
Tuckahoe marble, New York	6923	11,640							
Do	6924	17,746							
Do	6925	19,223							
Do	6966				177.8	13,333,300	15,384,600	$\frac{1}{2.5}$	.00000441
Do	6971				178.2	13,793,100	18,181,800		
Do	254			1,554					
Do	255			1,426					
Mount Vernon limestone, Kentucky	6899	5,247							
Do	6900	6,197							
Do	6901	11,566							
Do	6902	9,703							
Do	6903	7,226							
Do	6904	9,281							
Do	6905	6,618							
Do	6906	6,305							
Do	6907	6,681							
Do	6957				140.2	3,174,600	3,636,300		
Do	6958				138	3,225,800	3,076,900	$\frac{1}{2}$	.00000464
Do	237			2,016					
Do	238			1,711					
Do	239			1,389					
Oolitic limestone, Indiana									.00000437
North River bluestone, New York	6519	22,947				5,208,800	5,681,800		
Monson slate, Maine									.00000519
Cooper sandstone, Oregon	6940	14,920							

NATURAL STONES AND CEMENT—Continued.

Tabulation of results of compression, transverse, and shearing tests and coefficients of expansion in water.

Name of stone.	No. of test.	Compressive strength per square inch.	Transverse strength, maximum fiber stress.	Shearing strength per square inch.	Weight per cubic foot.	Compressive moduli of elasticity.		Ratio of lateral expansion to longitudinal compression.	Coefficient of expansion in water.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*		
Cooper sandstone, Oregon	6941	14,203							
Do	6942	16,366							
Do	6972				159.8	2,816,900	3,225,800	$\frac{1}{11}$	.00000177
Do	260			1,831					
Maynard sandstone, Massachusetts	6915	10,538							
Do	6916	9,223							
Do	6963				133.5	1,941,700	2,127,600	$\frac{1}{8}$	.00000567
Do	246			1,120					
Do	247			1,287					
Kibbe sandstone, Massachusetts	6917	10,063							
Do	6918	10,663							
Do	6964				133.4	1,834,900	2,298,800	$\frac{1}{3.5}$	.00000577
Do	250			992					
Do	251			1,308					
Worcester sandstone, Massachusetts	6919	9,656							
Do	6920	9,869							
Do	6962				130.6	2,439,000	2,898,500	$\frac{1}{6.5}$	.00000517
Do	248			1,383					
Do	249			1,102					
Potomac sandstone, Maryland									.00000500
Olympia sandstone, Oregon	7175	13,441							
Do	7176	12,061							
Do	7177	12,494							
Do									.00000320
Chuckanut sandstone, Washington	7178	10,276							
	7179	12,790							
	7180	11,100							
Do	261			1,352					
Dyckerhoff's cement									.00000578

EXPANSION OF STONES.

Diagrams Nos. 1 to 20, inclusive, showing the effect of treatment of stones in water and in air at different temperatures.

No. 1.

Expansion of Stones.

Brandford Granite, Conn.

Gauged length 20."0046

Treatment	Time	Temp.	Effect.
Open air		70°	
Storage tank, water	8d	67	.0011
Cold water	40h	34	0
Hot "	6h	211	.0184 *
Cold "	8h	34	.0043 *
" "	28h	"	.0044
Open air	54d	80	.0042
Hot "	2h	415	.0376
Cooled in air tank	16h	87	.0142

H Ex 92 53 3

No. 2.

Expansion of Stones.

Milford Granite, Mass.

Gauged length 20.″0004

Treatment	Time	Temp.	Effect
Open air		70°	
Storage tank; water	6d	70	.0015
Cold water	16h	34	.0002
Hot "	5h	211	.0170
Cold "	7h	34	.0035
Open air	30d	83	.0044
Hot "	2h	406	.0437
Cooled in air tank	17h	86	.0097
Open air	8d	83	.0098
" "	22d	88	.0090
Storage tank; water	17d	83	.0100
Open air	6d		.0073
Cold water	7h	34	.0212 *
Hot "	6h	212	.0073 *
Cold "	7h	34	

No. 3.

Expansion of Stones.

Milford Granite. Mass.

2nd Sample.

Gauged length 20.″0150

Treatment	Time	Temp.	Effect
		90°	″
Air	6h	34	-.0030
Cold water	22h	"	-.0028
" "	6h	212	s
Hot "	5h	"	.0137*
" "	7h	34	-.0011*
Cold "			

s Not measured.

Tested in a brass case, water not in direct contact with stone.

No. 4.

Expansion of Stones.

Troy Granite. N. H.

Gauged length 20".0050

Treatment	Time	Temp.	Effect
Open air		75°	
Storage tank, water	4d	69	.0020
Cold water	45h	34	.0011
Hot "	5h	209	.0150*
Cold "	6h	34	.0032*
Hot air	2h	430	.0462
Cooled in air tank	24h	82	.0080
Open air	7d	88	.0085
Storage tank, water	17d	83	.0090

H Ex 92 53 3

No. 5.

Expansion of Stones.

Creole Marble. Georgia.

Gauged length 20."0011

Treatment	Time	Temp.	Effect
Open air		80°	
Hot air	2h	460°	.0794
Cooled in air tank	16h	88°	.0254

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No. 7.

Expansion of Stones.

Marble Marble Hill, Ga.

Gauged length 29.0041

Treatment	Time	Temp.	Effect
Open air		75°	
Storage tank, water	48h	70	.0022
Cold water	6h	34	.0170 *
Hot "	4h	210	.0099 *
Cold "	5h	34	.0047
Open air	57d		.0356
Hot "	2h	435	.0350
Cooled in air tank	16h	78	.0328
Open air	88h	88	
Storage tank, water	17d	83	

No. 8.

Expansion of Stones.

Marble, Marble Hill, Ga.

Gauged length 19.9988

Treatment	Time	Temp.	Effect.
Air		70°	
Cold water	6h	34	.0008
" "	22h	"	.0006
Hot "	6h	212	.0129 *
Cooled in hot water	40h	81	.0059
Cold water	15h	34	.0063 *

Tested in a seated brass case, water not in direct contact with stone.

No. 9.

Expansion of Stones.

Lee Marble, Mass.

Gauged length 20".0314

Treatment	Time	Temp.	Effect
Open air		59°	
Storage tank, water	17d	68	.0008
Cold water	7h	34	.0013
" "	23h	"	.0013
Hot "	6h	212	.0170 *
Cooled in hot water	16h	87	.0051
Cold water	7h	34	.0008 *
Open air	14d	80	.0035
Hot "	2h	400	.0441
Cooled in air tank	16h	84	.0074
Open air	14d	88	.0070
Storage tank, water	17d	83	.0063

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No. 11.

Expansion of Stones

Mt. Vernon Limestone. Ky.

Gauged length 19.9957"

Treatment	Time	Temp.	Effect
Cold water	18h	34°	
Hot "	2h	208	.0127
" "	5h	199	.0128 *
Cold "	16h	34	.0095 *
Dried over boiler	8d		
Open air	17h	74	.0049
Hot "	2h	440	.0462
Cooled in air tank	16h	87	.0073
Open air	2d	88	.0067
Storage tank, water	17d	83	.0084

H Ex 92 53 3

No. 12.

Expansion of Stones.

Oolitic Limestone. Indiana.

Gauged length 20."0335

Treatment	Time	Temp.	Effect
Open air		59°	
Storage tank, water	17d	68	.0005
Cold water	16h	34	.0007
Hot "	6h	212	.0197 *
Cooled in hot water	16h	93	.0070
Cold water	7h	34	.0041 *
Open air	25d	80	.0059
Hot "	2h	432	.0562
Cooled in air tank	16h	89	.0108

No. 12.

Expansion of Stones.

Oolitic Limestone. Indiana.

Gauged length 20".0335

Treatment	Time	Temp.	Effect
Open air		59°	
Storage tank, water	17d	68	.0005
Cold water	16h	34	.0007
Hot "	6h	212	.0197 *
Cooled in hot water	16h	93	.0070
Cold water	7h	34	.0041 *
Open air	25d	80	.0059
Hot "	2h	432	.0562
Cooled in air tank	16h	89	.0108

No. 13.

Expansion of Stones.

Monson Slate. Maine.

Gauged length 20".0199

Treatment	Time	Temp.	Effect
Open air		59°	
Storage tank, water	17 d	68	.0008
Cold water	17 h	34	.0019
Hot "	6 h	212	.0166 *
Cooled in hot water	40 h	82	.0022
Cold water	7 h	34	.0019 *
Open air	10 d	88	.0021
Hot air	2 h	400	.0370
Cooled in air tank	16 h	90	.0032

Cold water	6h	34°	.0527
" "	30h	34°	.0532
" "	54h	34°	.0533
" "	118h	34°	.0534
" "	166h	34°	.0535
" "	310h	34°	.0541
Hot "	6h	212°	.0661 *
Cooled in hot water	16h	94°	.0555
Cold water	7h	34°	.0598 *
" "	77h	34°	.0598
Storage tank, water	7d	78°	.0582

H Ex 92 583

No. 15.

Expansion of Stones.

Maynard Sandstone, Mass.

Gauged length 20."0015

Treatment	Time	Temp.	Effect
Open air		75°	
Cold water	16h	34	.0030
Hot "	5h	203	.0038
Cold "	8h	34	.0057
Dried over boiler	6d		
Open air	17h	74	.0060
Hot air	2h	402	.0058
Cooled in air tank	16h	89	.0108
Open air	21d	88	.0101
Storage tank, water	17d	83	.0108
Open air	3d		
Cold water	17h	34	.0062
Hot "	5h	212	.0267 *
Cold "	6h	34	.0065 *

No. 16.

Expansion of Stones.

Kibbe Sandstone. Mass.

Gauged length 20."0108

Treatment	Time	Temp.	Effect.
Open air		75°	
Storage tank; water	54h	68	.0085
Cold water	15h	34	.0054
Storage tank water	24h	67	.0090
Hot water	6h	209	.0285 *
Cold "	18h	34	.0083 *
" "	23h	"	.0082
Open air	60d	85	.0096
Hot "	2h	420	.0606
Cooled in hot tank	16h	92	.0123
Storage tank; water	17d	83	.0135

No. 17.

Expansion of Stones.

Worcester Sandstone. Mass

Gauged length 20.″0107

Treatment	Time	Temp.	Effect
Open air		75°	
Storage tank, water	7 A	68	.0055
Cold water	16 h	34	.0033
Hot "	5 h	211	.0238 *
Cold "	8 h	34	.0055 *
Open air	56 A	88	.0066
Hot "	2 h	435	.0539
Cooled in air tank	40 h	80	.0079

No. 18.

Expansion of Stones.

Potomac Red Sandstone.

Gauged length 20.0938

Treatment	Time	Temp.	Effect.
Open air		59°	
Storage tank, water	17d	68	.0018
" "	21d	73	.0024
Cold water	26h	34	-.0003
Hot "	6h	212	.0185 *
Cooled in hot water	16h	81	.0043
Cold water.	7h	34	.0006 *
" "	40h	40	.0004
Hot "	6h	212	.0187
Plunged into cold water		34	
Cold water.	10h	50	.0022
" "	17h	34	.0009

No. 19

Expansion of Stones.

Olympia Sandstone, Wash.

Gauged length 20.0061

Treatment	Time	Temp.	Effect
Open air		80°	
Storage tank, water	9d	73	.0082
Cold water	7h	34	.0069
Hot "	10h	212	.0218 *
Cooled in water	16h	83	.0133
Cold water	24h	34	.0104 *

No. 20.

Expansion of Cement.

Prism of Dyckerhoff's cement.

Gauged length 20,"0101

Treatment	Time.	Temp.	Effect.
Open air	1 d		
Storage tank; water	15 d	68°	.0026
" "	68 d	83	.0062
Cold water	24 h	34	.0008
Hot "	6 h	212	.0248 *
Cold "	5 h	34	.0042 *

H Ex 92 53 3

BRICKS.

COMPRESSION TESTS.

BRICKS.

The tests of bricks have included compression, transverse, and shearing tests of the material. Tests of the elastic properties and coefficient of expansion determinations will follow in a subsequent report.

The compression test is the most common mechanical test by which the quality of the material is examined.

The results obtained are comparable when the tests are made under similar conditions and with brick of nearly the same dimensions.

So great is the influence, however, of the testing machine in aiding or reinforcing the material, that the results of tests of single bricks commonly accredit the material with a much higher strength than is available in actual structures.

This reinforcement in strength comes from the frictional resistance between the surfaces of the bricks and the flat steel compression platforms of the testing machine. When bricks are tested flatwise and have surfaces in close contact throughout with the testing machine, the tendency to fail by yielding laterally is sensibly checked by the friction between the compressed surfaces preventing the material flaking off the sides and assuming a truncated, conical mode of fracture.

In the tests herein reported the compression surfaces were leveled by a thin facing of plaster of paris, and an approximate uniform distribution of the loads thus obtained.

With some bricks this plaster cushion would possess nearly the same compressibility as the bricks themselves, but bricks differ very greatly in elastic properties; hence, this cushion can not at all times be equally well adapted for its purpose.

Practically plaster of paris has been found to give better results than other cushions, and it is believed that maximum results are generally developed.

Bricks tested on edge or on end would not derive so much reinforcement in strength from frictional resistance with the testing machine platforms, and this, combined with a want of perfect uniformity in strength of the material, would tend to lower the strength of bricks tested under these conditions in comparison with bricks tested flatwise.

Bricks tested in pairs, and when three, four, or five are tested together, show a reduction in strength over the tests of single bricks.

Brick piers range in strength from about 1,000 pounds per square inch to 4,500 pounds per square inch, depending on the quality of the brick and upon the dimensions of the pier and kind of mortar employed. These values, it will be observed, are much below the average strength of single brick of good quality.

Piers commonly fail by the development of longitudinal cracks caused by the transverse fracture of the individual bricks composing the pier.

Some of the bricks fail partially by direct compression when, owing to unequal distribution of load on irregular surfaces, crushing in detail occurs.

The manner of failure of piers emphasizes the importance of having bricks with flat bed surfaces when high strength is required, also in the use of strong mortar and securing as great transverse strength as possible among the bricks.

Laying several courses of bricks before breaking joints, or placing the bricks on edge, increases the transverse strength of the bricks, and experiments have shown these modifications in the ordinary manner of laying piers result in increased strength.

The present series of compression tests is supplemented by transverse and shearing tests.

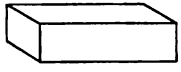
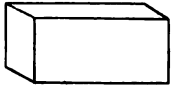
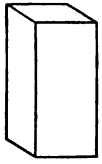
After rupture by transverse loads the half bricks were tested by compression.

A table follows the details of these tests showing the absorption of water after an immersion of one week by certain of the bricks.

Hard burnt Eastern face bricks.

[Color, red.]

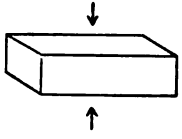
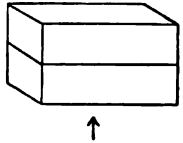
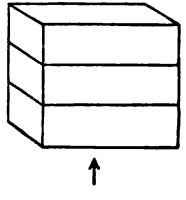
Tested to show relative strength according to the direction in which tested.

Test number.	Direction in which tested.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
	Flatwise.								
		Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
6520		2.16	7.76	3.56	27.63	136,000	308,400	11,162	
6521		2.10	7.68	3.55	27.26	128,000	367,800	13,492	
6522		2.19	7.78	3.57	27.77	108,000	298,500	10,749	
6523		2.21	7.75	3.60	27.90	149,000	259,200	9,290	
	Edgewise.								
6524		3.58	7.72	2.12	16.37	84,000	124,800	7,623	
6525		3.60	7.76	2.21	17.15	126,000	159,100	9,277	
6526		3.57	7.90	2.15	16.98	99,000	114,000	6,714	
6527		3.48	7.73	2.14	16.54	125,000	203,400	12,297	
	Endwise.								
6528		7.73	2.10	3.51	7.37	39,900	59,200	8,032	
6529		7.72	2.18	3.59	7.83	45,700	45,700	5,837	
6530		7.75	2.18	3.60	7.85	41,000	51,600	6,573	
6531		7.71	2.13	3.54	7.54	23,000	54,800	7,268	

Hard burnt Eastern face bricks.

[Color, red.]

Tested to determine relative strength of bricks tested singly, in pairs, threes, fours, and fives. Set in plaster of paris joints and compressed surfaces.

Test number.	Style of specimen.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
6841		2.20	7.74	3.74	28.95	218,000	458,500	15,837	
6842		2.12	7.82	3.78	29.56	145,000	269,000	9,100	
6843		4.40	7.80	3.77	29.41	81,000	178,500	6,069	
6844		4.35	7.78	3.77	29.33	149,000	199,800	6,812	
6845		6.48	7.77	3.75	29.14	93,000	127,200	4,365	
6846		6.60	7.78	3.74	29.10	126,000	169,600	5,828	

6847	8.75	7.79	3.76	29.29	103,000	122,100	4,168
6848	8.88	7.77	3.76	29.22	122,000	139,900	4,788
6849	10.05	7.76	3.73	28.94	126,000	131,100	4,530
6850	10.85	7.81	3.79	29.60	102,000	110,500	3,733
Half Bricks.							
6851	2.15	3.81	3.70	14.10	127,000	151,200	10,723
6852	2.12	3.92	3.75	14.70	145,000	169,100	11,503
6853	2.13	3.85	3.71	14.28	132,000	166,900	11,688
6854	2.11	3.74	3.75	14.02	125,800	170,100	12,133
6855	2.14	3.73	3.74	13.95	84,000	123,700	8,867

Bricks from the Hydraulic Press Brick Company, St. Louis, Mo.

[The samples were all medium hard burnt.]

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*In.*	*In.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7079	Medium red	2.28	4.17	8.48	35.36	156,000	186,200	5,266	
7080	Dark red	2.27	4.02	8.33	33.49	283,000	339,900	10,149	
7081	Paving stock	2.14	4.05	8.19	33.17	489,000	582,400	17,558	
7082	.....do	4.04	2.15	8.18	17.59	185,000	105,400	5,992	Tested on edge.
7083	No. 6 stock, dark red.	2.35	4.12	8.31	34.23	315,000	364,300	10,643	
7084	No. 10 stock, dark red.	2.30	4.00	8.17	32.68	376,000	571,000	17,472	
7085	No. 500 stock, buff, speckled.	2.32	4.12	8.22	33.87	268,000	319,200	9,424	
7086	No. 503 stock, light chocolate.	2.28	4.08	8.22	33.54	223,000	289,100	8,620	
7087	No. 504 stock, light chocolate, with dark speckles.	2.32	4.15	8.24	34.20	318,000	455,900	13,330	
7088	No. 509 stock, dark buff, with darker speckles.	2.35	4.12	8.33	34.32	265,000	305,700	8,907	
7089	No. 510 stock, buff, with dark speckles.	2.36	4.22	8.35	35.24	268,000	282,600	8,019	
7090	No. 511 stock, light buff.	2.32	4.12	8.33	34.32	207,000	279,500	8,144	
7091	Brown	2.40	4.08	8.46	34.52	261,000	305,900	8,861	

Bricks from the Hydraulic Press Brick Company, St. Louis, Mo.

[Half bricks, fragments after transverse tests were made.]

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*
7135	212	2.23	3.95	4.12	16.27	148,000	164,200	10,092
7136	212	2.23	3.95	4.15	16.39	169,000	173,900	10,610
7137	213	2.29	4.00	4.27	17.08	288,000	300,100	17,570
7138	213	2.29	4.00	3.91	15.64	216,000	278,800	17,826
7139	214	2.30	4.11	4.27	17.55	146,800	150,200	8,558
7140	214	2.30	4.11	3.91	16.07	129,000	135,500	8,432
7141	215	2.32	4.13	3.56	14.70	152,000	152,000	10,340
7142	215	2.32	4.13	4.68	19.33	180,000	205,400	10,626
7143	216	2.32	4.21	4.18	17.60	100,000	100,200	5,693
7144	216	2.32	4.21	4.22	17.77	96,900	96,900	5,453

Bricks from the Chicago Hydraulic Press Brick Company, Chicago, Ill.

[Medium hard burnt.]

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*In.*	*In.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7104	Brown	2.31	4.11	8.38	34.44	156,000	165,100	4,794	
7105	Red	2.33	4.10	8.42	34.52	174,000	192,400	5,574	
7106	.....do	4.07	2.32	8.32	19.30	100,200	100,200	5,192	Tested on edge.

Bricks from the Chicago Hydraulic Press Brick Company, Chicago, Ill.

[Half bricks, fragments after transverse tests were made.]

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*
7157	223	2.32	4.05	4.44	17.98	105,000	107,300	5,968
7158	223	2.32	4.05	3.89	15.75	82,300	82,300	5,225
7159	224	2.31	4.06	4.26	17.30	59,200	59,200	3,422
7160	224	2.31	4.06	4.16	16.89	52,100	52,700	3,120

Bricks from the Omaha Hydraulic Press Brick Company, Omaha, Nebr.

[Medium hard burnt. Color, red.]

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*In.*	*In.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7118	Shade No. 5.....	2.33	4.04	8.29	33.49	380,000	452,500	13,511	
7119	Shade No. 7.....	2.41	4.08	8.32	33.95	368,000	438,200	12,907	

Bricks from the Omaha Hydraulic Press Brick Company, Omaha, Nebr.

[Half bricks, fragments after transverse tests were made.]

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*
7163	226	2.38	4.11	4.13	16.97	227,000	229,800	13,542
7164	226	2.38	4.11	4.18	17.18	212,000	231,400	13,469

Bricks from the Northern Hydraulic Press Brick Company, Minneapolis, Minn.

[Specimens from the Menomonie yard, Wisconsin. Medium hard burnt. Dark red color.]

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*In.*	*In.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7116	.....	2.32	4.11	8.42	34.61	166,000	259,900	7,509	
7117	Dark red.....	2.32	4.08	8.42	34.35	248,000	260,200	7,575	

Bricks from the Northern Hydraulic Press Brick Company, Minneapolis, Minn.

[Half bricks, fragments after transverse tests were made.]

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*
7161	225	2.32	4.08	4.20	17.14	107,000	113,500	6,621
7162	225	2.32	4.08	4.22	17.22	112,200	112,700	6,545

Bricks from the Findlay Hydraulic Press Brick Company, Findlay, Ohio.

[Medium hard burnt.]

No of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total	Per square inch.	
		Inches.	*In.*	*In.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7092	12, dark red	2.31	4.02	8.24	33.12	238,000	320,800	9,686	
7093	18, dark red	2.27	4.06	8.16	33.13	259,000	409,900	12,372	
7094	14, dark red	2.27	4.05	8.20	33.21	243,000	372,000	11,201	

Bricks from Eastern Hydraulic Press Brick Company, Philadelphia, Pa. Works at Winslow, N. J.

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*In.*	*In.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7053	Shade 200, light-buff color.	2.21	4.01	8.11	32.52	332,000	481,900	14,818	
7054	.....do.....	2.21	4.00	8.08	32.32	381,000	509,100	15,752	
7055	Shade 210, slightly darker than shade 200.	2.26	4.00	8.08	32.32	371,000	445,100	13,771	
7056	.....do.....	4.00	2.18	8.02	17.48	162,900	162,900	9,319	Tested on edge.
7057	Shade 220, buff.....	2.20	3.95	8.10	31.99	335,700	519,900	16,252	
7058	.....do.....	2.20	3.97	8.08	32.08	339,000	464,700	14,485	
7059	Shade 300, buff, darker.	2.18	4.08	8.12	33.13	328,000	447,000	13,492	
7060	.....do.....	4.04	2.21	8.09	17.88	165,800	165,800	9,273	Do.
7061	Shade 390, gray.....	2.20	3.97	8.16	32.40	302,000	392,800	12,123	
7062	.....do.....	2.22	3.98	8.15	32.44	295,000	454,000	13,995	
7063	Shade 410, light chocolate.	2.22	3.98	8.10	32.24	355,000	486,200	15,081	
7064	.....do.....	3.94	2.22	8.19	18.18	166,000	180,800	9,945	Do.

Bricks from the Eastern Hydraulic Press Brick Company, Philadelphia, Pa.

[Half bricks, fragments after transverse tests were made.]

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*
7123	206	2.25	4.01	4.11	16.48	174,000	200,100	12,142
7124	206	2.25	4.01	4.00	16.04	196,000	216,600	13,504
7125	207	2.22	3.98	4.09	16.28	175,000	200,050	12,288
7126	207	2.22	3.98	3.93	15.64	199,000	216,100	13,817
7127	208	2.18	4.01	4.00	16.04	175,000	242,800	15,137
7128	208	2.18	4.01	4.06	16.28	218,000	262,600	16,130
7129	209	2.21	4.05	4.00	16.20	125,000	195,300	12,055
7130	209	2.21	4.05	4.10	16.60	149,000	204,800	12,337
7131	210	2.22	3.97	3.52	13.97	146,800	171,900	12,305
7132	210	2.22	3.97	4.62	18.34	187,000	230,800	12,584
7133	211	2.23	4.02	4.19	16.84	159,000	212,000	12,589
7134	211	2.23	4.02	3.98	16.00	164,000	210,300	13,144

Bricks from Philadelphia and Boston Face Brick Company, Boston, Mass.

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*In.*	*In.*	*Sq.in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7065	Salmon color	2.40	4.23	8.41	35.57	102,000	141,100	3,967	For inside work.
7066	.....do	2.38	4.22	8.41	35.49	119,000	135,800	3,826	For inside work.
7067	Light red	2.28	4.00	8.09	32.36	182,000	221,500	6,845	
7068	.....do	3.99	2.29	8.04	18.41	84,000	108,200	5,877	Tested on edge.
7069	.....do	2.27	3.95	7.97	31.48	249,000	296,200	9,409	
7070	Dark red	2.28	3.98	8.05	32.04	222,000	251,060	7,836	
7071	.....do	2.22	3.81	7.88	30.02	267,000	366,100	12,195	
7072	Chocolate brown	2.24	3.95	7.95	31.40	204,000	243,800	7,764	
7073	.....do	3.90	2.20	7.74	17.03	182,000	289,900	17,023	Do.
7074	Cream color	2.28	4.00	8.05	32.20	105,000	112,100	3,481	
7075	.....do	2.28	4.01	8.08	32.40	96,500	96,500	2,978	
7076	Buff	3.91	2.23	7.90	17.62	83,800	83,800	4,756	Do.
7077	.....do	2.22	3.91	7.88	30.81	280,000	320,600	10,406	
7078	Gray	2.28	3.99	8.04	32.08	123,200	123,200	3,840	

Nos. 7065 and 7066 were soft burnt. The other bricks were intended for outside work, and were harder burnt.

Bricks from the Philadelphia and Boston Face Brick Company, Boston, Mass.

[Half bricks, fragments after transverse tests were made.]

No. of test.	Transverse test number.	Dimensions.			Sectional area.	First crack.	Ultimate strength.	
		Height.	Compressed surface.				Total.	Per square inch.
		Inches.	*Inches.*	*Inches.*	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*
7145	217	2.24	3.85	4.74	18.25	146,000	191,300	10.482
7146	217	2.24	3.85	3.15	12.13	87,000	87,500	7,213
7147	218	2.21	3.82	3.55	13.56	106,000	135,600	10,000
7148	218	2.21	3.82	4.30	16.43	179,000	225,700	13,737
7149	219	2.21	3.85	4.43	17.06	108,000	151,500	8,880
7150	219	2.21	3.85	3.43	13.21	87,000	88,200	6,677
7151	220	2.26	3.98	4.09	16.28	44,800	44,800	2,752
7152	220	2.26	3.98	3.90	15.52	52,300	53,300	3,434
7153	221	2.25	3.99	4.02	16.04	122,000	132,100	8,236
7154	221	2.25	3.99	3.92	15.64	127,000	128,200	8,197
7155	222	2.26	3.99	3.90	15.56	38,200	38,200	2,455
7156	222	2.26	3.99	4.15	16.56	48,300	48,300	2,916

Bricks from the Brooke Terra Cotta Company, Lazearville, W. Va.

[Made by the dry press process, material called Columbian buff bricks.]

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*In.*	*In.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7098	No. 4, dark buff....	2.42	4.04	8.56	34.58	564,000	800,000	23,135	
7099	.....do.....	2.43	4.05	8.54	34.59	265,000	626,000	18,098	
7100	No. 5, medium dark buff.	2.44	4.12	8.57	35.31	247,000	346,800	9,822	
7101	.....do.....	2.42	4.11	8.54	35.10	234,000	423,900	12,077	
7102	No. 10, light buff...	2.35	3.98	8.32	33.11	158,000	607,200	18,339	
7103	.....do.....	2.32	3.95	8.24	32.55	372,000	612,200	18,808	

Bricks from the Kelley Brick and Tile Company, Minneapolis, Minn. Yards at Wrenshall, Minn.

[Sand-mold stiff mud brick, used for ordinary building purposes and sewer work.]

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*In.*	*In.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7095	Light straw color...	2.32	3.67	7.88	28.92	151,000	238,900	8,261	
7096	.....do.....	2.32	3.69	7.87	29.04	182,000	221,500	7,627	
7097	.....do.....	2.33	3.61	7.88	28.45	218,000	249,900	8,784	

Bricks from the Mather Brick Company Mankato, Minn.

The following description of these bricks was furnished by the manufacturers:

No. 7111 is a dry press brick, made from the same clays as the balance of our samples and burned in a down-draft kiln. The six remaining brick is what we term the soft mud sand brick, machine made, and burned in the common old Dutch up-draft scored kiln, taken from different locations in the kiln.

No. 7112, soft brick, next to scoring on the outside.

No. 7113, rain washed brick, over arch next to fire.

No. 7114, brick near top of kiln.

No. 7115, brick near center of kiln.

No. 7115*a*, hard burned.

No. 7115*b*, hard burned, 4 feet higher in kiln.

Bricks from the Mather Brick Company, Mankato, Minn.

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*In.*	*In.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7111	.....	2.27	4.14	8.31	34.40	350,000	379,900	11,043	
7112	.....	2.27	3.70	7.86	29.08	27,500	28,200	970	
7113	Red	2.19	3.60	7.67	27.61	72,100	72,100	2,611	
7114	Light	2.33	3.73	7.89	29.43	48,000	48,200	1,638	
7115	.....	2.29	3.70	7.84	29.01	28,000	28,500	982	
7115*a*	.....	2.32	3.69	7.85	28.97	42,500	45,700	1,577	
7115*b*	.....	2.34	3.55	7.98	28.33	68,200	68,200	2,407	

Paving bricks from the Franklin Paving Brick Company, Franklin, Pa.

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*In.*	*In.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
7107	Dark red	2.49	4.11	8.35	34.32	92,000	728,200	21,218	
7108	.....do.....	4.20	2.47	8.23	20.33	53,000	319,800	15,730	Tested on edge.
7109	.....do.....	4.12	2.52	8.44	21.27	117,000	242,000	11,377	Do.
7110	.....do.....	4.07	2.49	8.22	20.47	118,000	377,700	18,451	Do.

BRICKS.

Absorption of water.

Compression test number.	Contributor.	Weight, dry.		Absorption of water.			
				Total.		By weight.	By volume.
		Pounds.	*Ounces.*	*Pounds.*	*Ounces.*	*Per ct.*	*Per ct.*
7079	Hydraulic Press Brick Company, St. Louis	5	1⅜	.....	14⅜	18.0	31.5
7081	.....do	5	2	.....	8½	10.1	20.0
7082	.....do	5	1⅜	.....	8½	10.1	20.0
7089	.....do	6	⅛	.....	7¼	8.0	16.1
7090	.....do	5	13	.....	9	9.6	19.0
7091	.....do	5	7⅜	.....	13⅛	15.4	28.1
7104	Chicago Hydraulic Press Brick Company	5	7	.....	12⅜	14.6	27.7
7105	.....do	5	7⅜	.....	13	14.8	27.9
7119	Omaha Hydraulic Press Brick Company	5	12	.....	10½	11.4	22.2
7116	Northern Hydraulic Press Brick Company	5	6½	.....	12⅛	14.8	27.4
7054	Eastern Hydraulic Press Brick Company	5	7½	.....	6	6.9	14.5
7057	.....do	5	7	.....	4⅛	5.5	11.6
7059	.....do	5	5⅜	.....	6⅛	7.9	16.1
7061	.....do	5	4½	.....	6	7.1	14.5
7064	.....do	5	7	.....	4⅛	5.5	11.4
7065	Philadelphia and Boston Face Brick Company	5	4½	1	½	19.2	32.9
7066	.....do	5	3⅜	.....	15⅝	18.8	32.2
7067	.....do	5	4	.....	9½	11.0	21.6
7070	.....do	5	4⅜	.....	8⅛	10.0	20.1
7075	.....do	4	9	.....	18½	18.1	31.0
7078	.....do	4	11⅜	.....	11⅛	15.2	27.1
7098	Brooke Terra Cotta Company	6	½	.....	6½	6.7	13.4
7099	.....do	5	12	.....	7⅜	8.4	15.9
7100	.....do	5	15⅜	.....	9	9.4	18.0
7101	.....do	6	⅜	.....	8⅛	8.8	17.2
7102	.....do	5	15½	.....	5⅛	5.8	12.2
7103	.....do	5	11⅛	.....	5⅜	6.3	13.1
7111	Mather Brick Company	5	4	.....	11⅛	13.7	25.4
7112	.....do	3	7½	.....	14⅜	26.7	38.6
7115	.....do	3	8	.....	14⅛	25.4	37.0
7115*a*	.....do	3	10½	.....	14	24.0	36.0
7115*b*	.....do	3	10	.....	12⅛	21.5	32.6

BRICKS.

TRANSVERSE TESTS.

BRICKS.

TRANSVERSE TESTS.

Bricks from the Hydraulic Press Brick Company, St. Louis, Mo.

No. of test.	Description.	Distance between end supports.	Dimensions.		Ultimate strength.	
			Breadth.	Depth.	Total.	Modulus of rupture, R.
		Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*
212	Dark red	6	3.95	2.23	1,645	754
213	No. 10 stock	6	4.00	2.29	1,939	833
214	No. 500 stock	6	4.11	2.30	2,002	829
215	No. 504 stock	6	4.13	2.32	2,118	868
216	No. 510 stock	6	4.21	2.32	1,520	604

The fragments were tested by compression and recorded with the tests of whole bricks.

Bricks from the Chicago Hydraulic Press Brick Company, Chicago, Ill.

No. of test.	Description.	Distance between end supports.	Dimensions.		Ultimate strength.	
			Breadth.	Depth.	Total.	Modulus of rupture, R.
		Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*
223	Red brick	6	4.05	2.32	1,102	455
224	Brown	6	4.06	2.31	742	308

The fragments were tested by compression and recorded with the tests of whole bricks.

Bricks from the Northern Hydraulic Press Brick Company, Minneapolis, Minn.

No of test.	Description.	Distance between end supports.	Dimensions.		Ultimate strength.	
			Breadth.	Depth.	Total.	Modulus of rupture, R.
		Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*
225	Dark red	6	4.08	2.32	1,110	455

The fragments were tested by compression and recorded with the tests of whole bricks.

Bricks from the Omaha Hydraulic Press Brick Company, Omaha, Nebr.

No of test.	Description.	Distance between end supports.	Dimensions.		Ultimate strength.	
			Breadth.	Depth.	Total.	Modulus of rupture, R.
		Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*
226	Shade 6	6	4.11	2.38	3,216	1,244

The fragments were tested by compression and recorded with the tests of whole bricks.

Bricks from the Eastern Hydraulic Press Brick Company, Philadelphia, Pa.

No. of test.	Description.	Distance between end supports.	Dimensions.		Ultimate strength.	
			Breadth.	Depth.	Total.	Modulus of rupture, R.
		Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*
206	Shade 200	6	4.01	2.25	2,110	936
207	Shade 210	6	3.98	2.22	2,685	1,232
208	Shade 220	6	4.01	2.18	2,257	1,066
209	Shade 300	6	4.05	2.21	1,660	756
210	Shade 390	6	3.97	2.22	2,258	1,038
211	Shade 400	6	4.02	2.23	2,163	974

The fragments were tested by compression and recorded with the tests of whole bricks from this lot.

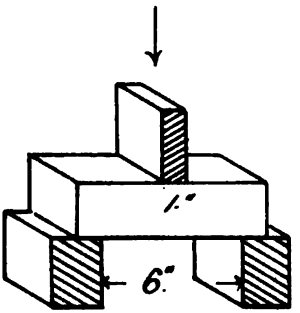
Bricks from the Philadelphia and Boston Face Brick Company, Boston, Mass.

No. of test.	Description.	Distance between end supports.	Dimensions.		Ultimate strength.	
			Breadth.	Depth.	Total.	Modulus of rupture, R.
		Inches.	*Inches.*	*Inches.*	*Pounds.*	*Pounds.*
217	Light red	6	3.85	2.24	1,686	785
218	Dark red	6	3.82	2.21	2,160	1,043
219	Chocolate brown	6	3.85	2.21	1,548	741
220	Cream	6	3.98	2.26	1,284	568
221	Buff	6	3.99	2.25	1,926	858
222	Gray	6	3.99	2.26	810	358

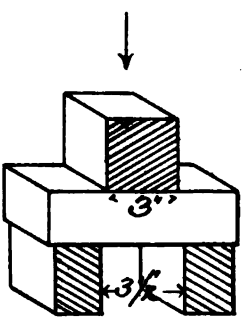
The fragments were tested by compression, and recorded with the tests of whole bricks.

Tests of Brick

Arrangement of specimens.



Transverse tests.



Shearing tests.

H Ex 92 53 3

BRICKS.

SHEARING TESTS.

BRICKS.

SHEARING TESTS.

Bricks from the Hydraulic Press Brick Company, St. Louis, Mo.

No. of test.	Description.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
					Total.	Per square inch.	
		Inches.	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
230	No. 6 stock.....	2.34×4.14×2	19.37	6,500	19,580	1,011	One.
231	No. 511 stock....	2.32×4.13×2	19.16	4,300	12,300	642	Two.
232	Brown color....	2.39×4.02×2	19.21	5,150	20,120	1,047	One.

Brick from the Chicago Hydraulic Press Brick Company, Chicago, Ill.

No. of test.	Description.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
					Total.	Per square inch.	
		Inches.	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
235	No. 10, red.....	2.27×3.99×2	18.11	4,600	14,190	784	One.

Brick from the Northern Hydraulic Press Brick Company, Minneapolis, Minn.

No. of test.	Description.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
					Total.	Per square inch.	
		Inches.	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
236	No. 4, dark red..	2.32×4.08×2	18.93	3,750	13,520	714	One.

Bricks from the Eastern Hydraulic Press Brick Company, Philadelphia, Pa.

No. of test.	Description.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
					Total.	Per square inch.	
		Inches.	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
227	Shade 210.....	2.23×3.99×2	17.80	4,800	20,780	1,167	One.
228	Shade 220.....	2.21×3.97×2	17.55	7,600	19,250	1,097	One.
229	Shade 390.....	2.20×3.96×2	17.42	10,100	17,220	988	Two.

Bricks from the Philadelphia and Boston Face Brick Company, Boston, Mass.

No. of test.	Description.	Shearing dimensions.	Shearing area.	Transverse fracture developed on tension side.	Shearing strength.		Surfaces sheared.
					Total.	Per square inch.	
		Inches.	*Sq. inches.*	*Pounds.*	*Pounds.*	*Pounds.*	
233	Gray color.....	2.26×3.99×2	18.03	4,500	7,800	433	Two.
234	.....do	2.26×3.95×2	17.85	4,100	11,400	639	One.

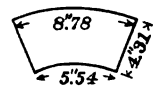
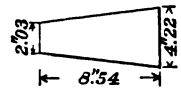
BUILDING MATERIAL FROM WORLD'S COLUMBIAN EXPOSITION, CHICAGO, ILL. CONTRIBUTED FROM THE STATE OF FLORIDA.

No. of test.	Description.	Marks.	Dimensions.			Sectional area.	Weight, dry		Absorption of water.				First crack.	Ultimate strength.		Remarks.
			Height.	Compressed surface.					Total.		By weight.	By volume.		Total.	Per square inch.	
			Inches.	*In.*	*In.*	*Sq. in.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Per ct.*	*Per ct.*	*Lbs.*	*Pounds.*	*Pounds.*	
6547	Lime rock		2.44	7.95	3.97	31.56	4	7¾		13	18.2	29.2	26,800	26,800	849	Mined in Citrus County; color, white; hardens on exposure to the air.
6548	do		2.43	8.02	3.92	31.44	4	5½		13¾	19.8	31.1	25,850	25,850	822	
6549	do		2.52	8.13	4.00	32.52	4	10½		15	20.1	31.6	36,300	36,300	1,116	
6550	do		2.44	8.10	4.00	32.40	4	10¾		12¾	17.1	27.9	48,700	48,700	1,503	
6551	Slop brick, burned clay.		2.38	4.30	3.78	16.25	2	1⅝		7	20.7	31.2	32,000	57,900	3,563	Half brick. Burned clay; color, nearly white; irregular shapes.
6552	do		2.28	3.65	3.60	13.14	1	10½		5½	19.8	30.2	32,550	32,550	2,477	Half brick.
6553	Fernandina Brick Company, red brick.		2.44	8.23	3.98	32.76	5	3¾		9⅛	11.4	20.5	76,100	87,300	2,665	
6554	do		2.57	8.47	4.12	34.90	5	6¼		12	13.9	23.1	148,000	177,200	5,077	
6555	do		2.55	8.42	4.08	34.35	5	5¼		11⅛	13.5	22.7	158,000	164,200	4,780	
6679	Shell rock		3.75	6.01	5.62	33.78							48,600	48,600	1,439	White; sawed from beds; in putty-like condition when taken from the quarry; hardens on exposure to the air.

BUILDING MATERIAL FROM WORLD'S COLUMBIAN EXPOSITION, CHICAGO, ILL. CONTRIBUTED FROM THE STATE OF ILLINOIS.

No. of test.	Description.	Marks.	Dimensions.			Sectional area.	Weight, dry.		Absorption of water.				First crack.	Ultimate strength.		Remarks.
			Height.	Compressed surface.					Total.		By weight.	By volume.		Total.	Per square inch.	
			Inches.	*In.*	*In.*	*Sq. in.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Per ct.*	*Per ct.*	*Lbs.*	*Pounds.*	*Pounds.*	
6640	Fire brick	Re-pressed fire brick from Utica Fire Brick Co., Utica, Ill., "XX."	2.66	9.20	4.39	40.39	7	5¾	.....	15½	12.9	24.5	57,000	171,400	4,244	Cream color.
6641	.....do	.....do	2.65	9.00	4.32	38.88	7	7	.....	11	9.2	18.6	72,000	154,200	3,966	Buff.
6642	Building brick	"Bushnell Pressed Brick Co., Bushnell, Ill., No. 50."	2.30	8.03	3.82	30.67	5	1¾	.....	8¾	10.8	21.4	202,000	223,800	7,297	Do.
6643	.....do	.....do	2.29	8.03	3.78	30.35	4	15½	.....	8½	10.7	21.1	201,000	209,900	6,916	Do.
6644	Vitrified brick	.....	2.25	7.67	3.58	27.46	5	6	.....	¼	0.29	0.70	72,000	337,200	12,280	Dark red.
6645	.....do	.....	2.24	7.73	3.62	27.98	5	7¼	.....	0	0	0	83,000	230,900	8,252	Do.
6646	Building brick	.....	2.38	8.27	3.90	32.25	5	7¾	.....	9⅛	10.8	21.4	282,000	361,100	11,197	Red.
6647	.....do	Geo. T. Walter & Co., manufacturers of first-class drain tile and brick, Chatsworth, Ill.	2.17	8.20	4.04	33.13	4	14¾	.....	9½	11.7	22.2	130,000	228,000	6,881	Light red.
6650	Paving block	Peoria Paving Block Company, manufacturers of street, paving, building, and sidewalk brick. The large paving brick a specialty. Peoria, Ill.	4.05	5.77	4.63	26.72	18	9½	.....	8	1.0	2.3	151,000	148,100	5,543	Pieces of some paving block which was broken into halves when received; greenish brown color.
6651	.....do	.....do	4.05	6.25	4.63	28.94							182,000	189,700	6,555	

BUILDING MATERIAL FROM WORLD'S COLUMBIAN EXPOSITION, CHICAGO, ILL. CONTRIBUTED FROM THE STATE OF KENTUCKY.

No. of test.	Description.	Marks.	Dimensions.			Sectional area.	Weight, dry.		Absorption of water.			First crack.	Ultimate strength.		Remarks.
			Height.	Compressed surface.					Total.		By weight.	By volume.		Total.	Per square inch.	
			Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Per cent.*	*Per cent.*	*Pounds.*	*Pounds.*	*Pounds.*	
6630	Fire brick	L. F. B. Wks. XX	2.43	9.02	4.43	39.96	7	2½	....	10¾	9.4	19.1	61,000	188,200	4,709	Buff.
6631	do	L. F. B. Wks. No. 1	2.49	9.04	4.58	41.40	7	8	....	11⅓	9.3	18.8	96,000	204,400	4,937	Do.
6648	do	L. F. B. Wks	2.42			31.69	6	⅜	....	6¾	7.0	15.3	181,000	306,800	9,681	Cream color.
6649	do	do	2.42			26.69	5	1½	....	5	6.1	13.4	145,000	173,300	6,493	Do
6860	Oolitic limestone.	McLellan Stone Co., Bowling Green, Ky.	3.49	6.40	6.10	39.04	....	....	....	....	....	....	189,000	584,100	14,962	
6861	do	Hopkinsville Stone Co., Christian County, Ky.	4.78	5.41	4.90	26.51	....	....	....	....	....	....	51,000	207,400	7,824	
6862	do	Bowling Green Stone Co., Louisville, Ky.	6.20	5.85	6.10	35.68	....	....	....	....	....	....	172,000	219,700	6,157	
6863	Sandstone	Carreyville, Ky	4.30	4.81	4.58	22.03	....	....	....	....	....	....	88,000	233,900	10,617	

BUILDING MATERIAL FROM WORLD'S COLUMBIAN EXPOSITION, CHICAGO, ILL. CONTRIBUTED FROM THE STATE OF MINNESOTA.

TEST OF BRICKS.

No. of test.	Description.	Marks.	Dimensions.			Sectional area.	Weight, dry.		Absorption of water.				First crack.	Ultimate strength.		Remarks.
			Height.	Compressed surface.					Total.		By weight.	By volume.		Total.	Per square inch.	
			Inches.	*In.*	*In.*	*Sq. in.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Per ct.*	*Per ct.*	*Pounds.*	*Pounds.*	*Pounds.*	
6595	John Lind & Co., Barnum red brick.	.....	2.28	7.94	3.67	29.25	4	4½	.....	9½	13.8	24.7	36,000	80,200	2,742	
6596	Red brick	"From F. X. Goulet's yard, Staples, Minn."	2.24	7.86	3.87	30.41	4	9½	.....	10	18.6	25.3	102,000	176,100	5,791	Pressed; one end nearly vitrified.
6597	.....do	.....	2.15	7.54	3.72	28.05	4	2½	.....	7	10.5	20.0	54,000	192,000	6,845	
6598	Buff brick (light)	.....	2.53	8.26	3.76	31.06	3	15½	1	3	30.0	41.8	46,800	46,800	1,507	From Peter Becker.
6599	.....do	"Lundgren Bros., Warren brick, New Quaker."	2.35	7.66	3.60	27.58	3	14½	.....	10½	16.8	27.9	56,000	147,200	5,337	
6600	Pearl color brick .	"F. A. New Ulm." ..	2.35	8.62	4.26	36.72	6	½	.....	10½	10.9	21.0	92,000	154,100	4,196	Has an elliptical panel on one side ".27 deep.
6601	Buff color brick...	"O. R. Mather. Pelican Rapids, Minn."	2.27	8.17	3.92	32.03	3	13½	1	½	26.7	39.2	106,000	111,300	3,475	
6602	Red brick	.....	2.42	8.30	4.05	33.61	5	1½	.....	13½	16.9	29.2	66,000	92,000	2,737	Pressed.
6603	Buff color brick...	.....	2.40	8.08	3.88	31.35	4	6½	.....	13½	19.6	31.5	109,000	214,200	6,833	From Fred Hatheggen, Carlton.
6604	.....do	.....	2.43	7.93	3.52	27.91	3	15	.....	11½	17.9	28.6	38,000	117,400	4,206	From Dangs & Wiest, Blakely.
6605	.....do	.....	2.38	7.84	3.50	27.44	3	14½	.....	11	17.7	29.1	44,000	114,500	4,173	Do.
6606	.....do	"Hess & Moog, St. Cloud."	2.25	8.23	3.86	31.77	3	8½	1	½	28.1	39.3	98,000	140,300	4,416	
6607	.....do	"Peter Becker, Bella Plaine."	2.42	8.12	3.70	30.04	3	15½	.....	15½	24.5	36.8	74,000	77,600	2,583	
6608	.....do	.....	2.30	8.26	4.05	33.45	3	13½	1	3½	31.4	43.2	75,800	75,800	2,266	From O. R. Mather, Pelican Rapids.
6609	Red brick, hard burnt.	.....	2.30	7.70	3.72	28.64	4	8½	.....	8	11.1	21.0	63,000	212,000	7,402	From A. C. Ochs.
6610	Buff color brick ..	"Hess & Moog, St. Cloud."	2.25	8.26	3.88	32.05	3	11½	1	0	27.0	38.2	95,000	131,000	4,087	
6611	Red brick	.....	2.15	7.94	3.83	30.41	3	12¾	.....	10¾	17.7	28.4	37,500	40,100	1,311	From J. A. McKay, Alexandria.
6612	.....do	.....	2.26	8.05	3.80	30.59	4	14½	.....	10¼	15.0	25.6	87,000	90,050	2,944	From M. Mueller, Stillwater.
6613	Dry slate shale brick, semi-dry.	.....	2.29	8.45	4.07	34.39	5	13¾	.....	8	8.5	17.5	238,000	249,200	7,246	From St. Louis River Slate Brick Company.

TEST OF BRICKS—Continued.

No. of test.	Description.	Marks.	Dimensions.			Sectional area.	Weight, dry.		Absorption of water.				First crack.	Ultimate strength.		Remarks.
			Height.	Compressed surface.					Total.		By weight.	By volume.		Total.	Per square inch.	
			Inches.	*In.*	*In.*	*Sq. in.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Per ct.*	*Per ct.*	*Pounds.*	*Pounds.*	*Pounds.*	
6614	Alexandria building brick, red.		2.14	7.79	3.82	29.76	3	12½	.....	8½	14.5	23.7	51,000	62,700	2,107	
6615	Red brick		2.16	7.87	3.64	28.65	4	3¼	.....	6½	10.0	18.8	158,000	202,100	7,054	From M. Mueller, Stillwater.
6616	Dry slate shale brick, semi-dry, pressed.		2.34	8.49	4.10	34.81	6	¾	.....	9	9.3	19.1	202,000	208,500	5,990	From St. Louis Slate Brick Company.
6617	Red brick		2.32	8.09	3.74	30.26	4	8½	.....	10¼	14.4	25.8	45,000	73,900	2,442	From John Lind Barnum.
6618	Red brick, light, pressed.		2.20	7.88	3.83	30.18	4	5¾	.....	10¾	15.4	27.9	132,000	159,900	5,298	From F. X. Goulet's Staples.

TEST OF STONES.

6661	Kasota pink limestone.		4.82	4.88	4.92	24.01	.....	.....	.....	.....	.....	.....	174,000	261,300	10,883	From quarries of C. W. Babcock & Co., Kasota, Minn.
6662	Mankato sandstone.		4.05	4.08	4.11	16.77	.....	.....	.....	.....	.....	.....	130,000	161,100	9,606	Light yellow, mottled.
6663	Mautorville sandstone.		3.96	3.99	4.03	16.08	.....	.....	.....	.....	.....	.....	141,100	141,100	8,775	Light drab.
6664	Frontinac sandstone.		3.96	4.00	3.96	15.84	.....	.....	.....	.....	.....	.....	148,000	160,200	10,114	Do.
6665	Luverne quartzite		4.23	4.12	3.93	16.19	.....	.....	.....	.....	.....	.....	349,000	349,000	21,556	Dark red garnet color.
6666	.....do		4.22	3.97	4.03	16.00	.....	.....	.....	.....	.....	.....	299,000	318,000	19,875	Do.
6667	Ortonville granite		4.03	3.90	4.02	15.68	.....	.....	.....	.....	.....	.....	300,200	320,100	20,415	Pink.
6668	Duluth brownstone.		3.98	3.96	4.02	15.92	.....	.....	.....	.....	.....	.....	69,300	69,300	4,353	
6669	Faribault marble		4.28	4.29	4.23	18.15	.....	.....	.....	.....	.....	.....	137,000	322,700	17,780	Drab.

BUILDING MATERIAL FROM WORLD'S COLUMBIAN EXPOSITION, CHICAGO, ILL. CONRTIBUTED FROM THE STATE OF IOWA.

TESTS OF STONES.

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
6670	Cedar Valley limestone	3.98	3.99	4.07	16.24	89,800	89,800	5,053	Fractured stone has a strong petroleum smell; cream color.
6671	Crowley's mottled limestone	4.11	4.14	4.00	16.56	147,900	147,900	10,743	Mottled cream color and dark brown.
6684	....do	7.10	7.47	7.56	56.47	165,000	276,200	4,891	Do.
6676	Hutcherson blue limestone	4.55	4.10	5.80	23.78	257,000	573,600	24,121	
6672	Iowa State Quarry limestone	4.16	4.14	4.34	17.97	129,500	129,500	7,206	T. Fairchilds, owner; drab.
6685	....do	4.45	4.40	4.12	18.13	65,900	65,900	3,634	Quarried in 1843; in wall of house until April, 1893.
6674	Ruble rock, straw color	2.90	2.97	4.72	14.02	132,700	132,700	9,465	J. A. Green, Stone City, Iowa.
6858	Gypsum, Fort Dodge	5.67	5.93	6.09	36.11	104,700	104,700	2,899	White, with streaks of greenish brown.
6859	Limestone, Johnson County	6.11	5.44	6.41	34.87	162,700	162,700	4,666	
6675	Fire stone, Johnson County	2.50	4.10	3.98	16.32	67,000	78,900	4,834	Mrs. L. Englerto's quarry.

TESTS OF BRICKS.

No. of test.	Description.	Marks.	Dimensions.			Sectional area.	Weight, dry.		Absorption of water.				First crack.	Ultimate strength.		Remarks.
			Height.	Compressed surface.					Total.		By weight.	By volume.		Total.	Per square inch.	
			Inches.	*In.*	*In.*	*Sq. in.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Per ct.*	*Per ct.*	*Pounds.*	*Pounds.*	*Pounds.*	
6619	Buff brick.....	Fort Dodge Clay Works, Iowa.	2.28	7.71	3.83	29.53	4	12½	.....	7	9.2	18.0	138,000	249,500	8,449	
6620	.....do.....	.....do.....	2.28	7.70	3.83	29.49	4	12½	.....	7½	9.5	18.6	183,000	291,900	9,898	
6621	Building brick....	J.C.Holman & Bro., Sargents Bluff.	2.20	8.00	3.86	30.88	4	12½	.....	7¾	10.1	19.7	86,000	196,100	6,350	Dark buff.
6622	Paving brick	.....do.....	2.25	7.66	3.73	28.57	4	13	.....	1¼	1.6	3.3	88,000	271,000	9,485	Dark brown, nearly black.
6623	.....do.....	.....do.....	2.23	7.82	3.82	29.87	4	14½	.....	4	5.1	10.4	99,000	259,100	8,674	Do.
6624	Brick.....	.....	2.22	8.04	3.88	31.20	5	½	.....	6¾	8.4	16.8	97,000	248,800	7,974	Dark red.
6625	Paving brick	Davenport Paving Brick and Tile Co., Davenport.	2.17	7.97	4.08	32.52	5	10½	.....	1	1.1	2.4	71,000	301,800	9,280	Brown.
6626	.....do.....	.....	2.16	7.90	3.99	31.52	5	8	.....	¾	0.85	1.9	59,000	253,600	8,046	Do.
6627	.....do.....	Muscatine Terra Cotta Lumber Co., Muscatine, Iowa.	2.34	7.83	3.74	29.28	5	6	.....	1¼	1.4	3.1	97,000	329,600	11,257	Do.
6628	.....do.....	.....do.....	2.30	7.78	3.96	30.81	5	7¾	.....	1¾	1.4	3.0	110,000	378,000	12,269	Do.
6629	Building brick....	.....do.....	2.42	8.15	4.17	33.99	5	9¾	.....	10	11.1	21.0	101,000	198,100	5,828	Red.

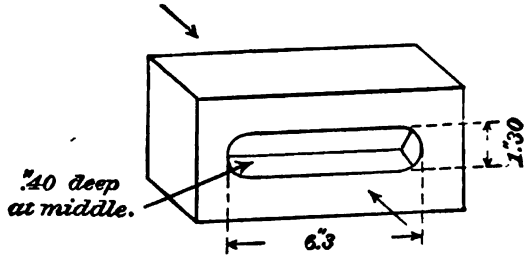
BUILDING MATERIAL FROM WORLD'S COLUMBIAN EXPOSITION, CHICAGO, ILL. CONTRIBUTED FROM THE STATE OF ARKANSAS.

No. of test.	Description.	Marks.	Dimensions.			Sectional area.	Weight, dry.		Absorption of water.			First crack.	Ultimate strength.		Remarks.
			Height.	Compressed surface.					Total.		By weight.	By volume.		Total.	Per square inch.	
			Inches.	*In.*	*In.*	*Sq. in.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Per ct.*	*Per ct.*	*Pounds.*	*Pounds.*	*Pounds.*	
6556	Paving brick, decomposed shale.	Doyle	2.14	8.02	3.78	30.32	5	8¾		1½	1.4	3.3	143,000	287,100	9,469	Dark red; very hard burnt, approaching vitrification.
6557	do	do	3.88	8.04	2.08	16.72	5	5½		2½	2.6	6.0	62,000	112,900	6,752	
6558	Facing brick	do	2.19	8.24	4.06	33.45	5	2¾		10½	12.3	24.2	42,000	176,900	5,288	Light red; medium burnt.
6559	do	do	2.20	8.25	4.04	33.33	5	1½		10½	12.9	24.7	54,000	169,800	5,094	
6560	Fire brick	do	2.36	8.54	4.22	36.04	5	1½	1	2	22.0	36.5	91,000	128,300	3,560	Deep salmon color.
6561	do	do	2.40	8.46	4.20	35.53	5	1¼	1	1½	21.5	35.4	78,000	123,100	3,465	
6654	Shale		3.38	6.14	5.23	32.11							280,000	791,000	24,634	From E. W. Pascoe, Batesville, Ark.
6655	Limestone		4.35	6.90	5.90	40.71							153,000	385,100	9,460	

BUILDING MATERIAL FROM WORLD'S COLUMBIAN EXPOSITION, CHICAGO, ILL. CONTRIBUTED FROM THE STATE OF SOUTH DAKOTA.

No. of test.	Description.	Dimensions.			Sectional area.	First crack.	Ultimate strength.		Remarks.
		Height.	Compressed surface.				Total.	Per square inch.	
		Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	*Pounds.*	
6657	Sandstone, Black Hills Quarry Company	4.01	4.10	4.12	16.89	121,000	177,900	10,532	Pink color.
6659	do	4.01	4.17	4.08	17.01	142,900	142,900	8,401	Buff color.
6660	do	3.95	4.01	3.94	15.80	93,800	93,800	5,937	Light-drab color.
6658	Sandstone, Mount Lookout Quarry	4.09	4.01	4.02	16.12	72,800	72,800	4,516	Light red
6682	Sandstone, Evans Quarry	4.90	4.34	4.82	20.92	131,900	131,900	6,305	Buff.
6777	Sandstone, Lem Creek Quarry Company	5.00	4.95	5.45	26.98	102,000	150,600	5,582	Pink.
6683	do	3.92	4.88	4.63	22.59	102,100	102,100	4,520	Do.
6868	do	2.92	3.87	2.18	8.44		6,680	791	Tested wet, after 20 hours' immersion in water; pink.
6866	Sandstone, Evans Quarry (best)	4.40	4.69	4.70	22.04	165,100	165,100	7,491	
6943	Jasper, paving block	4.19	4.23	4.20	17.77	219,000	553,100	31,125	C. W. Hubbard; brown.

BUILDING MATERIAL FROM WORLD'S COLUMBIAN EXPOSITION, CHICAGO, ILL. CONTRIBUTED FROM THE STATE OF COLORADO.



No. of test.	Description.	Marks.	Dimensions.			Sectional area.	Weight, dry.		Absorption of water.				First crack.	Ultimate strength.		Remarks.
			Height.	Compressed surface.					Total.		By weight.	By volume.		Total.	Per square inch.	
			Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Per cent.*	*Per cent.*	*Pounds.*	*Pounds.*	*Pounds.*	
6566	Red face brick		2.43	8.40	4.05	34.02	5	6¼	....	13¼	15.3	28.2	142,000	149,980	4,408	From Golden Pressed and Fire Brick Company, Denver, Colo.
6567	....do		2.42	8.36	4.04	33.77	5	3½	....	13⅜	16.2	29.1	122,000	123,200	3,648	
6568	Cream face brick		2.41	8.44	4.06	34.27	5	4½	....	12⅜	14.8	26.7	172,000	212,100	6,189	
6569	Dark buff face brick		2.30	8.43	3.98	33.55	5	6¼	....	6½	7.2	13.7	214,000	299,800	8,936	
6570	Buff face brick		2.47	8.55	4.07	34.80	5	9⅜	....	9⅜	10.6	19.4	209,000	231,000	6,638	
6656	Lava stone		4.11	4.06	4.05	16.44	....	....	....	....	.....	.....	99,800	99,800	6,071	Light drab.

BUILDING MATERIAL FROM WORLD'S COLUMBIAN EXPOSITION, CHICAGO, ILL. CONTRIBUTED FROM THE STATE OF WYOMING.

No. of test.	Description.	Marks.	Dimensions.			Sectional area.	Weight, dry.		Absorption of water.				First crack.	Ultimate strength.		Remarks.
			Height.	Compressed surface.					Total.		By weight.	By volume.		Total.	Per square inch.	
			Inches.	*In.*	*In.*	*Sq. in.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Per ct.*	*Per ct.*	*Pounds.*	*Pounds.*	*Pounds.*	
6571	Red face brick....	Boyd Brick Press..	2.20	7.70	3.82	29.41	5	¾	.....	4	5.0	10.7	379,000	384,600	13,077	
6572	.....do.....	.....do.....	2.24	7.77	3.86	29.99	5	1	.....	5½	6.5	13.5	301,000	316,800	10,563	
6573	.....do.....	.....do.....	2.20	7.73	3.83	29.61	4	15½	.....	4½	6.0	12.6	309,000	327,500	11,060	

BUILDING MATERIAL FROM WORLD'S COLUMBIAN EXPOSITION, CHICAGO, ILL. CONTRIBUTED FROM THE TERRITORY OF UTAH.

No. of test.	Description.	Marks.	Dimensions.			Sectional area.	Weight, dry.		Absorption of water.				First crack.	Ultimate strength.		Remarks.
			Height.	Compressed surface.					Total.		By weight.	By volume.		Total.	Per square inch.	
			Inches.	*In.*	*In.*	*Sq. in.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Per ct.*	*Per ct.*	*Pounds.*	*Pounds.*	*Pounds.*	
6636	Buff facing brick.....	.....	2.38	8.48	4.25	36.04	5	¾	1	3½	24.1	40.1	155,000	157,200	4,362	
6637	.....do.....	.....	2.37	8.49	4.24	36.00	4	14½	1	4	25.4	40.5	119,000	122,500	3,403	
6638	Red facing brick.....	.....	2.47	8.46	4.22	35.70	6	½	.....	12	12.5	23.5	194,000	194,200	5,440	
6639	.....do.....	.....	2.45	8.46	4.19	35.45	5	9½	.....	14½	14.5	25.8	113,500	113,500	3,202	

BUILDING MATERIAL FROM WORLD'S COLUMBIAN EXPOSITION, CHICAGO, ILL. CONTRIBUTED FROM THE STATE OF IDAHO.

No. of test.	Description.	Marks.	Dimensions.			Sectional area.	Weight, dry.		Absorption of water.				First crack.	Ultimate strength.		Remarks.
			Height.	Compressed surface.					Total.		By weight.	By volume.		Total.	Per square inch.	
			Inches.	*In.*	*In.*	*Sq. in.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Per ct.*	*Per ct.*	*Pounds.*	*Pounds.*	*Pounds.*	
6562	Face brick, Albany Falls.	.....	2.47	8.60	4.22	36.29	5	6¾	1	2¾	21.6	36.1	217,000	237,000	6,530	Light red.
6563	.....do.....	.....	2.29	7.99	3.87	30.92	5	9	.....	5½	5.9	12.8	508,000	697,600	22,561	Very hard burnt.
6564	.....do.....	.....	2.44	8.57	4.20	35.99	5	7¾	1	1½	19.9	34.4	249,000	266,100	7,393	Light red.
6565	.....do.....	.....	2.42	8.43	4.12	34.73	5	8½	.....	14¼	16.1	29.3	339,000	365,900	10,535	Medium hard burnt.
6680	Calcite.....	.....	3.90	4.50	4.38	19.71	.....	.....	.....	.....	.....	.....	210,800	210,800	10,695	White.
6684	Sandstone.....	Pocatello	7.97	7.93	7.98	63.28	.....	.....	.....	.....	.....	.....	76,900	76,900	1,215	Light drab.
6681	Volcanic.....	Bear Lake.....	6.00	5.07	3.35	16.98	.....	.....	.....	.....	.....	.....	51,950	51,950	3,059	

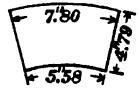
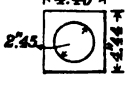
BUIILDNG MATERIAL FROM WORLD'S COLUMBIAN EXPOSITION, CHICAGO, ILL. CONTRIBUTED FROM THE STATE OF WASHINGTON.

No. of test.	Description.	Marks.	Dimensions.			Sectional area.	Weight dry.		Absorption of water.				First crack.	Ultimate strength.		Remarks.
			Height.	Compressed surface.					Total.		By weight.	By volume.		Total.	Per square inch.	
			Inches.	*In.*	*In.*	*Sq. in.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Per ct.*	*Per ct.*	*Pounds.*	*Pounds.*	*Pounds.*	
6532	Everett Electric Brick Company, light-red brick.	.....	2.28	8.08	3.92	31.67	4	8½	.....	13	18.0	31.1	104,000	126,200	3,984	Soft burnt.
6533	Everett Electric Brick Company, dark-red brick.	.....	2.11	7.68	3.60	27.65	4	7⅛	.....	3½	5.2	11.1	69,000	216.950	7,846	Hard burnt.
6534	Facing brick, Denny Clay Comp'y.	"We challenge the world for strength."	2.45	8.98	4.48	40.23	6	13⅜	.....	6½	5.6	11.0	250,000	505,800	12,573	Cream color.
6535	.....do.....	.....do.....	2.38	8.89	4.45	39.56	6	6¾	.....	6	5.8	11.0	309,000	519,700	13,137	Do.
6536	Fire brick, Denny Clay Company.	.....	2.31	8.77	4.33	37.97	5	13⅛	.....	11¼	12.0	22.1	59,900	104,980	2,765	Light buff.
6537	.....do.....	.....	2.37	8.77	4.29	37.62	5	15½	.....	11¾	12.3	22.8	43,000	90,450	2,405	Do.
6538	Vitrified paving brick, Denny Clay Company.	Denny Clay Co....	4.23	8.78	2.70	23.71	7	12¼	.....	⅛	0.4	0.86	49,000	288,100	12,151	Tested on edge; dark brown; surfaces have a glazed appearance from vitrification of material.
6539	.....do.....	.....do.....	2.61	8.76	4.08	35.74	7	12½	.....	1	0.8	1.85	155,000	761,000	21,283	Cream color; from Puget Sound Brick, Tile and Terra Cotta Company, Seattle.
6540	Building brick....	"P. S. B. T. & T. C. Company, Seattle, Wash., P. O. Box 472."	2.40	8.44	4.23	35.70	5	14½	.....	11⅛	12.2	23.1	114,000	170,200	4,767	
6541	.....do.....	.....do.....	2.50	8.52	4.20	35.78	5	15⅛	.....	12⅛	13.1	24.1	82,800	108,200	3,024	Cream color.
6543	Building brick, Everett Electric Brick Company.	"E. E. B. Co.".....	2.39	8.18	4.00	32.72	4	14¼	.....	13⅜	17.1	30.5	81,900	131,050	4,005	Red; have sunken panel 4".9 × 1".9 by ".20 deep.
6544	.....do.....	.....do.....	2.38	8.14	3.96	32.23	4	11½	.....	13½	17.6	29.8	81,000	145,800	4,524	Red.
6545	Pressed building brick, C. A. Sherman, Spokane, Wash.	.....	2.48	8.67	4.23	36.67	5	2¾	.....	19⅜	23.5	37.0	89,900	98,800	2,694	Dark cream color.
6546	.....do.....	.....	2.40	8.32	4.07	33.86	5	3½	.....	13	15.5	27.6	232,000	281,100	8,302	Darker cream color, streaked with red.
6678	Marble.....	.....	6.00	6.57	6.16	37.39	.....	.....	.....	.....	.....	.....	230,000	335,400	8,972	Roche Harbor, San Juan County.
6867	.....do.....	.....	2.28	3.08	3.62	11.15	.....	.....	.....	.....	.....	.....	52,100	52,100	4,673	Snoqualmie district.
6865	Granite.....	.....	3.15	3.85	4.33	16.67	.....	.....	.....	.....	.....	.....	93,000	330,200	19,808	Do.

BUILDING MATERIAL FROM WORLD'S COLUMBIAN EXPOSITION, CHICAGO, ILL. CONTRIBUTED FROM JAPAN.

No. of test.	Description.	Marks.	Dimensions. Height.	Dimensions. Compressed surface.		Sectional area.	Weight, dry.		Absorption of water. Total.		By weight.	By volume.	First crack.	Ultimate strength. Total.	Per square inch.	Remarks.
			Inches.	*In.*	*In.*	*Sq. in.*	*Lbs.*	*Oz.*	*Lbs.*	*Oz.*	*Per ct.*	*Per ct.*	*Pounds.*	*Pounds.*	*Pounds.*	
6634	Japanese fire brick, white.	[illegible]	2.48	9.21	4.38	40.33	7	½	.....	10¾	9.6	18.6	108,000	223,000	5,529	
6635	.....do.....	.....do.....	2.50	9.31	4.45	41.43	7	5¾	.....	11	9.3	18.2	107,000	196,100	4,782	

BUILDING MATERIAL FROM WORLD'S COLUMBIAN EXPOSITION CHICAGO, ILL. CONTRIBUTED FROM SWEDEN.

No. of test.	Description.	Marks.	Dimensions. Height.	Dimensions. Compressed surface.		Sectional area.	Weight, dry.		Absorption of water. Total.		By weight.	By volume.	First crack.	Ultimate strength. Total.	Per square inch.	Remarks.
			Inches.	*Inches.*	*Inches.*	*Sq. in.*	*Lbs*	*Oz.*	*Lbs*	*Oz.*	*Per cent.*	*Per cent.*	*Pounds.*	*Pounds.*	*Pounds.*	
6574	Brick from Sweden.	.....	1.93	8.33	4.20	34.99	5	4½	....	2	2.3	5.1	108,000	785,000	22,485	Drab.
6575	.....do.....	.....	1.93	8.33	4.16	34.85	5	3½	....	1½	1.8	3.9	295,000	800,000	22,955	Maximum load not reached; brown.
6584	Fire brick from Sweden.	.....	2.47	7.43	4.77	35.44	5	13¾	....	8½	8.8	16.3	148,000	248,700	7,017	
6585	.....do.....	.....	2.43	7.47	4.86	36.30	5	14½	....	8½	8.7	16.1	132,000	236,000	6,501	
6586	.....do.....	.....	2.27			31.14	4	13½	....	8½	11.0	21.5	126,000	184,900	5,937	
6587	.....do.....	.....	2.27			32.04	4	13½	....	8½	11.0	19.1	132,000	196,000	6,117	
6589	.....do.....	.....	8.06			14.82	8	2¾	....	13½	10.3	19.5	68,000	74,100	5,000	

WOODS.

COMPRESSION TESTS

WOODS—COMPRESSION TESTS.

At the close of the World's Columbian Exposition samples of wood were contributed for tests from the States of Kentucky, Florida, and California, and a railway tie from the New South Wales exhibit.

The Kentucky samples were from trees all of which were cut in the month of April, 1893. The samples were immediately shipped to the Exposition in an unseasoned condition, where they remained during the Exposition without adequate opportunity for seasoning.

The tests were made sixteen months after the trees were felled, and some of the samples, mentioned in the details of the tests, showed unseasoned wood.

The results on this account must be accepted as rather understating the strength of the woods represented.

The samples of cabbage palm from Florida and redwood from California were in a partially seasoned state when tested.

Exceptional strength was developed by the iron bark tie from New South Wales, the ultimate strength reaching 8,738 pounds per square inch.

All the wood samples were tested endwise the grain.

COMPRESSION TESTS OF WOOD SPECIMENS CONTRIBUTED FROM THE STATE OF KENTUCKY AT THE WORLD'S COLUMBIAN EXPOSITION, CHICAGO, ILL.

General shapes of the sections of blocks from which specimens were taken, the figures in the column of dimensions R being the radius of piece, and generally represented the radius of the tree from which block was cut.

No. of test.	Common name.	County where grown.	Dimensions R.	Rings per inch.	Specific gravity.	Dimensions of specimens.			Sectional area.	Ultimate strength.		Description of failure.
						Length.	Width.	Thickness.		Total.	Per square inch.	
			Inches.			*Inches.*	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	
7342	Magnolia		8	4	.6639	30.00	5.93	5.97	35.40	102,600	2,898	Fibers crushed 6″ from end.
7397	do		10½	.....	.5357	16.60	8.03	7.94	63.76	172,800	2,710	Do.
7365	do		8	.....	.7001	24.70	7.00	6.91	48.37	123,400	2,551	Fibers crushed 7″ from end at group of knots.
7395	do		10	.....	.6584	16.75	7.96	6.93	55.16	195,800	3,550	Oblique fracture along middle of length.
7388	Sweet bay		6½	.....	.6331	17.43	5.90	4.99	29.44	88,200	2,996	Fibers crushed 5″ from end.
7329	Yellow poplar	Purchase	18	.....	.7136	33.69	7.89	7.98	62.96	146,500	2,327	Fibers crushed 7″ from end.
7349	Basswood		9½	.....	.3677	28.72	6.93	7.84	54.33	65,600	1,207	Fibers crushed at middle of length.
7382	Ironwood		4	.....	.7647	19.10	2.93	2.10	6.15	32,100	5,219	Triple flexure.
7373	Cinnamon wood		6½	5	.9752	23.06	5.79	4.83	27.97	91,700	3,278	Oblique fracture along length following shakes.
7334	Rock maple	Warren	6½	.....	.8186	32.20	8.00	8.03	64.24	209,100	3,255	Fibers crushed 7″ from end. Partially decayed wood.
7378	Sugar maple	Breathitt	7	.....	.5004	20.20	8.07	8.05	64.96	163,500	2,517	Fibers crushed near middle. Partly decayed.
7352	do	Warren	5	.....	.7385	27.76	5.00	4.99	24.95	99,700	3,996	Fibers crushed 6″ from end.
7379	White maple	Breathitt	6	9	.7399	20.26	7.90	7.88	62.25	256,900	4,126	Oblique fracture near middle of length.
7366	Water maple	Warren	8½	.....	.5206	24.46	5.99	5.98	35.82	115,600	3,227	Fibers crushed near middle. Partly decayed.
7370	Silver maple		6½	11	.4807	23.52	4.91	3.86	18.95	50,300	2,654	Fibers crushed 7″ from end. Decayed wood.
7374	Box elder	Warren	9	.....	.4856	23.00	5.95	5.93	35.28	93,900	2,661	Fibers crushed at middle of length.
7359	Honey locust	do	10	8	.8887	25.64	5.96	5.92	35.28	127,600	3,617	Oblique fracture 6″ from end.
7383	do		6¾	7	.8016	18.08	4.98	4.98	24.80	76,200	3,072	Fibers crushed at knots ⅜″ diameter.
7364	Black locust	Warren	6½	.....	.7873	24.79	4.00	3.01	12.04	65,100	5,407	Fibers crushed 6″ from end.
7402	Yellowwood	do	9½	.....	.7409	14.89	5.90	5.84	34.46	104,800	3,041	Crushed at end. Oblique grain.
7330	Kentucky coffee tree.	do	14	4	.7330	34.30	7.87	7.87	61.93	195,300	3,154	Fibers crushed 17″ from end.
7389	Holly		5½	.....	.6346	17.38	5.83	3.87	22.56	65,700	2,912	Fibers crushed at middle of length.
7346	Wild cherry	Warren	12	10	.6953	29.57	7.87	7.86	61.86	207,700	3,357	Crushed at middle. Heart wood partially decayed. Brittle.
7385	do		5	.....	.7163	17.58	5.90	4.00	23.60	116,900	4,953	Fibers crushed 9″ from end.
7331	Sweet gum	Purchase	14½	.....	.6721	35.30	6.82	6.75	46.03	97,300	2,114	Fibres crushed 6″ from end. Wood slightly decayed.
7355	Black gum	Warren	11½	.....	.5552	26.69	7.08	7.05	49.91	153,700	3,079	Fibers crushed near middle of length.
7399	Gum		9¾	.....	.5418	16.62	7.81	6.88	53.73	114,900	2,138	Fibers crushed 4″ from end.

7398	.....do	.....	10	.....	.5292	16.70	7.92	7.90	62.57	132,100	2,111	Fibers crushed near end.
7325	White ash	Warren...	5½	14	.6416	32.59	6.00	6.06	36.36	93,700	2,577	Oblique fracture at middle. Stick slightly decayed.
7345	.....do	.....do	21	13	.6988	31.53	7.98	7.98	63.68	195,200	3,065	Fibers crushed 8" from end.
7371	Blue ash.....	.....do	9½	16	.6474	23.39	6.02	5.99	30.06	131,100	3,636	Fibers crushed near middle of length.
7391	Swamp ash	.....	9½	.....	.5586	17.22	7.95	6.96	55.33	139,900	2,528	Fibers crushed.
7377*	Sassafras	Knox	15½	11	.6529	20.54	7.94	7 92	62.88	112,600	1,791	Oblique fracture near end.
7376	Slippery elm.....	.....	4½	24	.6112	20.95	2.91	2.04	5.94	23,100	3,889	Triple flexure.
7380	Red elm.....	Warren...	9½	.....	.7170	20.18	6.99	6.97	48.72	189,700	3,894	Oblique fracture at end.
7327	.....do	Purchase.	16	.....	.6046	33.33	8.04	8.02	64.48	114.500	1,776	Fibers crushed at middle of length.
7341	.....do	Warren...	17	10	.6361	29.73	5.98	4.92	29.42	105,200	3,576	Fibers crushed at knot at middle ⅜" diameter.
7372	White elm.....	Breathitt.	16	.....	.6438	22.93	8.02	7.88	63.20	160,500	2,544	Fibers crushed near middle. Crossgrained.
7328	.....do	Warren...	17½	.....	.5725	33.10	8.04	8.03	64.56	140,400	2,175	Fibers crushed 4" from end.
7353	Hackberry.....	.....do	11½	6	.5806	27.54	5.99	4.98	29.83	81,200	2,722	Triple flexure.
7387	.....do	.....	6	9	.4815	17.66	4.82	3.88	18.70	41,200	2,203	Triple flexure 4" from end.
7358	Mulberry.....	Warren...	9	9	.5868	26.12	4.98	4.98	24.80	76,300	3,077	Fibers crushed near middle.
7323	Sycamore.....	Purchase.	13	.....	.6368	36.87	7.89	7.91	62.41	84,300	1,351	Oblique fracture 19" long.
7400	.....do	.....	5	.....	.5641	16.48	6.02	2.84	17.10	47,900	2,801	Fibers crushed near middle. Defective heart wood.
7347	Butternut	.....	6½	9	.6079	29.34	5.93	3.92	23.25	44,600	1,918	Fibers crushed 2" from end.
7340	Black walnut.....	Warren...	10	4	.7722	30.25	5.00	5.03	25.15	103,400	4,111	Oblique fracture 4" from end.
7394	Pecan	.....	6	12	.7706	16.82	5.00	3.84	19.20	76,600	3,990	Oblique fracture 5" from end.
7348	Hickory	Warren...	12	20	.9164	29.02	7.97	7.99	63.68	285,700	4,486	Fibers crushed near middle of length.
7367	.....do	Breathitt.	22½	14	.9272	24.38	7.80	7.88	61.46	242,500	3,946	Oblique fracture at end.
7381	.....do	.....do	12	10	.6627	20.12	7.99	7.98	63.76	238,600	3,742	Crushed at middle of length.
7335	Scaly bark hickory.	Warren...	12	17	.8797	31.85	7.87	7.90	62.17	204,300	3,286	Crushed at knots 11" from end.
7362	Mocker nut hickory.	Breathitt.	11½	20	.8789	25.31	7.00	6.88	48.16	190,100	3,947	Fibers crushed at end.
7360	Pig hickory.....	Warren...	9½	7	.7576	25.60	5.97	5.97	35.64	135,500	3,802	Fibers crushed at knot 1" diameter 4" from end.
7390	White hickory.....	.....	7½	12	.8972	17.25	7.98	5.97	47.34	228,100	4,818	Oblique fracture along middle of length.
7388	White oak.....	Purchase.	20	10	.8568	33.48	7.90	7.90	62.41	142,100	2,276	Triple flexure.
7332	.....do	Knox	.....	15	.9397	34.71	7.89	7.87	62.09	188,200	3,031	Fibers crushed at end.
7396	.....do	.....	8½	16	.8717	16.80	6.80	5.90	40.12	130,500	3,253	Fibers crushed along middle of length.
7333	Overcup white oak.	Warren...	17	9	.9184	32.55	8.10	8.05	65.20	154,300	2,367	Crushed at one end.
7375	Post oak.....	.....do	.....	.....	.7903	22.71	4.07	4.07	16.56	50,500	3,049	Fibers crushed 7" from end.
7361	Swamp white oak.	.....do	12	7	.9140	25.57	7.00	6.00	42.00	139,600	3,324	Crushed at one end.
7350	Chestnut oak.....	.....do	14	11	.9078	28.59	7.88	6.86	54.06	200,700	3,712	Oblique fracture near middle of length.
7392	Chinquapin oak...	.....	8½	8	.6885	17.07	7.98	5.97	47.64	170,600	3,581	Fibers crushed along middle of length.
7337	Red oak	Warren...	14	10	.6675	33.72	7.72	7.22	59.60	180,700	3,032	Oblique fracture 14" long beginning at end of stick.
7351	Scarlet oak	.....do	14½	6	.7554	27.85	8.05	8.00	64.40	170,500	2,647	Fibers crushed 8" from end.
7356	Spanish oak.....	.....do	12	12	.7554	26.18	6.98	6.91	48.23	116,800	2,422	Fibers crushed 11" from end.
7369	Water oak.....	.....do	9½	7	.8296	23.65	5.97	5.96	35.58	102,300	2,875	Triple flexure.
7384	.....do	.....	7	9	.7294	17.91	6.28	3.96	24.87	83,900	3,373	Oblique fracture near middle.
7354	Shingle oak.....	Warren...	7½	9	.8380	27.55	6.00	4.99	29.94	113,700	4,465	Oblique fracture at end.
7344	Beech.....	.....do	15	11	.8543	30.00	8.01	7.98	63.92	199,800	3,126	Failed at knots near end; partially decayed.
7401	.....do	.....	7	20	.7015	16.35	6.83	6.00	40.98	140,500	3,428	Crushed near middle of length.
7386	Water beech.....	.....	3½	.....	.8676	17.60	3.84	2.92	11.21	46,700	4,166	Fibers crushed 6" from end.
7322	Birch	Purchase.	14	.....	.6576	35.17	7.92	8.00	63.36	166,400	2,626	Fibers crushed 4" from end.
7393	Willow	.....	6½	.....	.4725	17.00	4.83	3.92	18.93	40,600	2,145	Fibers crushed 5" from end.

* Considerable sap flowed from this stick during the test.

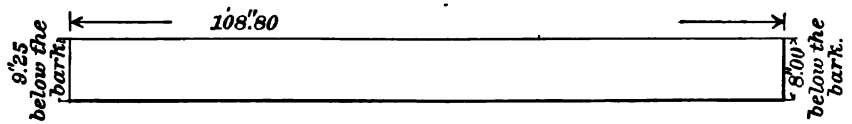
COMPRESSION TESTS OF WOOD SPECIMENS CONTRIBUTED FROM THE STATE OF KENTUCKY, ETC.—Continued.

No. of test.	Common name.	County where grown.	Dimensions R.	Rings per inch.	Specific gravity.	Dimensions of specimens.			Sectional area.	Ultimate strength.		Description of failure.
						Length.	Width.	Thickness.		Total.	Per square inch.	
			Inches.			*Inches.*	*Inches.*	*Inches.*	*Sq. in.*	*Pounds.*	*Pounds.*	
7326	Cottonwood	Warren	17	14	.6614	32.18	8.50	8.52	72.42	127,800	1,765	Oblique fracture 10″ long beginning at one end.
7327	Red cedar	do	5½	.....	.5617	26.25	4.91	4.87	23.91	102,300	4,278	Crushed at knots at end of stick.
7339	Cypress	Purchase	15	18	.5998	33.38	8.04	8.03	64.56	207,600	3,216	Fibers crushed 8″ from end.
7343	Virginia cypress	.....	7½	13	.7315	31.37	6.92	6.92	47.89	123,700	2,583	Failed at knots near end.
7336	Yellow pine	Knox	12	18	.6808	33.88	7.90	7.89	62.33	244,600	3,924	Fibers crushed in vicinity of knot 10″ from end.
7324	do	.....	13	12	.4641	35.98	8.00	8.02	64.16	125,800	1,961	Fibers crushed at knot 1½″ diameter.
7363	Aller boxwood	.....	4½	10	.9228	24.98	5.88	3.11	18.29	48,200	2,635	Crushed near the end. Oblique grain.

CABBAGE PALM FROM FLORIDA.

No. 6856.

This tree stood in front of Florida building.
Felled November 2, 1893; tested four and one-half months later.
Total height of tree, 12′.
Diameter at ground, 14½″.
Diameter at top, 9″.



Weight (includes bark), 238 pounds.
Weight per cubic foot, 46.7 pounds.
Diameters over the bark, { lower end, 11″.3. upper end, 9″.
Sectional area (minimum), 50.27 square inches.
This specimen was not straight; maximum deflection from a straight line drawn from end to end of log, 1½″.
Compression measurements taken over end of log.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
1,000	.....	0.	.....	Initial load.
4,000	.....	.03	.....	
10,000	.....	.08	.....	
15,000	.....	.11	.....	
20,000	.....	.14	.....	
25,000	.....	.17	.....	
30,000	.....	.22	.....	
33,000	.....	.37	.....	
33,600	.....	.62	.....	
38,000	.756	2.00	.....	Ultimate strength.
23,000	.....	4.80	.....	After passing the ultimate strength.

Failure occurred at the smaller end of the log. The fibers were crushed at the immediate end.

There was a decided yielding of the log under 33,600 pounds, but after further yielding the load rose to 38,000 pounds, the maximum stress reached.

Along 6 inches in length of the log the fibers were crushed, and lateral movement occurred at this end.

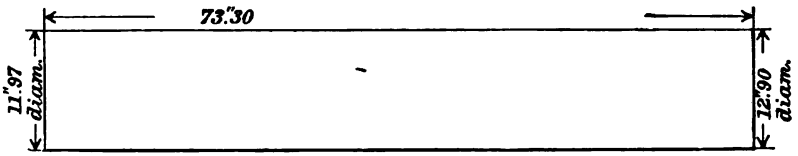
About 1 quart of sap flowed from the wood at the part crushed.

Four feet in length taken along the middle and straightest part of the log were cut out to be retested after further seasoning. This piece weighed 127½ pounds when cut out.

Redwood From California.

No. 6857.

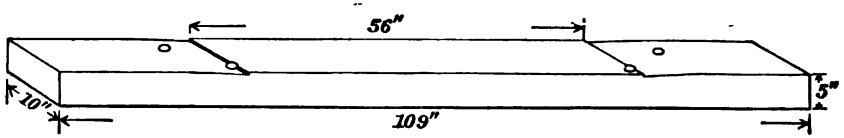
Grown in Santa Cruz Mountains.
Felled March, 1893; tested one year later.



Weight (includes bark about $\frac{5}{8}$" thickness) 306 pounds.
Weight per cubic foot, 59.4 pounds.
Average rate of growth, 10 rings per inch.
Total number of rings of growth 61, of which 44 are heart wood and 17 are sap wood.
Sectional area (minimum), 112.53 square inches.
Ultimate strength, 504,900 pounds=4,487 pounds per square inch.
Fibers crushed in the vicinity of knots 4" to 7" from the smaller end. The knots were $\frac{3}{4}$" diameter.
Sap exuded from the specimen where the fibers were crushed.

Specimen taken from an Iron Bark Railroad Tie from New South Wales.

No. 7368

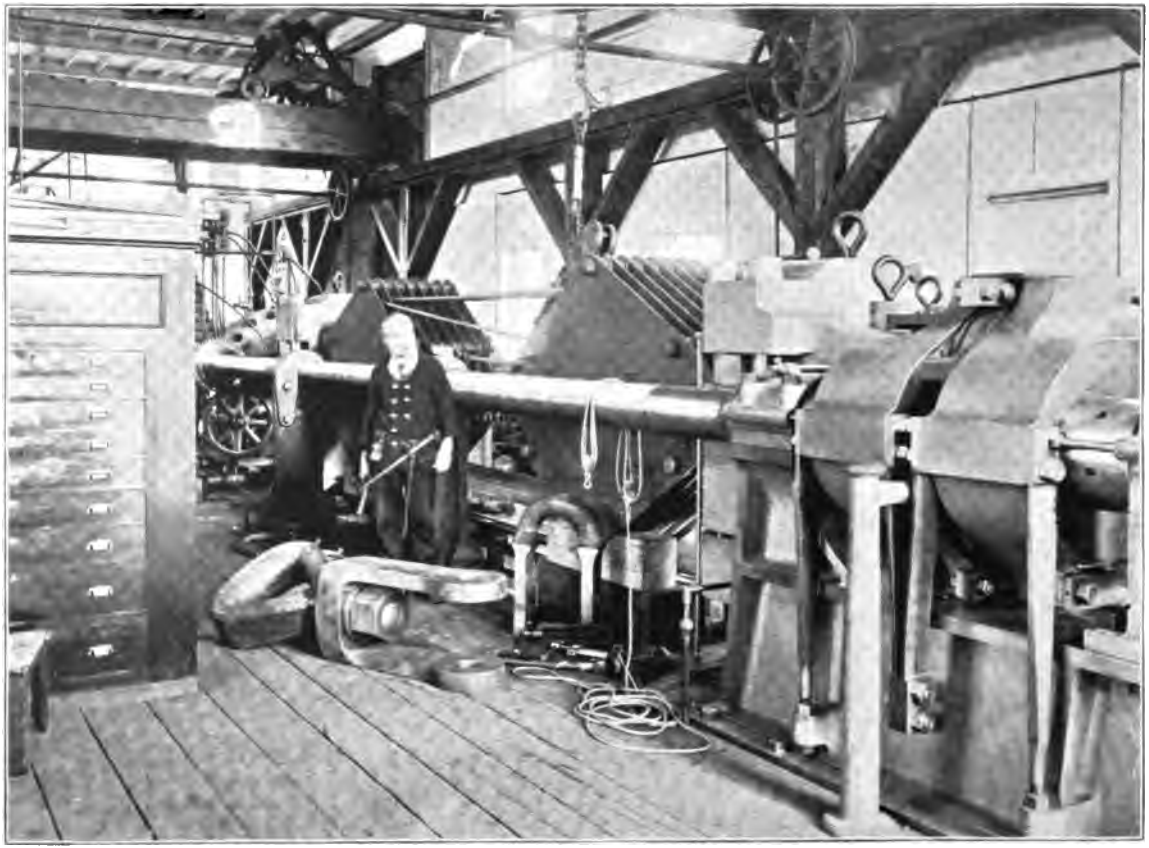


Dimensions of specimen, { length, 24".08. width, 6".04. thickness, 4".92.
Sectional area, 29".72.
Specific gravity, .9851.
Ultimate strength, 259,700 pounds=8,738 pounds per square inch.

100-TON TACKLE BLOCKS.

PROOF TEST BY TENSILE STRESS OF 100-TON TACKLE BLOCKS FOR THE BUREAU OF YARDS AND DOCKS, U. S. NAVY.

The blocks were manufactured by The Thomas Laughlin Company, Portland, Me., and were intended for use in some hoisting shears at the Boston Navy-Yard.



TACKLE BLOCKS, 100 TONS.

Photograph of tensile test of 100-tons tackle blocks.

Name plate on blocks:
"The Thomas Laughlin Co.
Block Makers.
Portland, Me., 1893."

No. 6514.

TEST OF THE BLOCKS.

Blocks rove with $1\frac{1}{8}$" steel wire rope, one end secured to becket, the other end hitched to traveling crane of the testing machine, and used to apply a load to the blocks while the latter were allowed to travel enough to turn the first sheave one-half a rotation. The load on the blocks during this period of the test ranged from 100,000 to 120,000 pounds. After this each end of the rope was secured to the blocks and a load of 224,000 pounds' tension applied and allowed to remain acting a period of five minutes.

Finally the sheaves were turned part of a rotation, as in the first period, while working under a load ranging from 100,000 to 120,000 pounds, but reversing the direction of the sheaves by hauling with the traveling crane from the end first secured to the becket, the opposite end now being secured to an opposite becket.

No. 6515.

TEST OF THE SWIVEL.

Special eye bars secured the swivel to the testing machine at one end and a stirrup at the other.

A load of 224,000 pounds' tension was applied and allowed to remain acting for an interval of five minutes.

The blocks and swivel were examined after testing, but no injury appeared to have resulted.

GAUTIER STEEL BARS.

GAUTIER STEEL BARS FROM ENDURANCE SHAFTS.

Two sets of tension tests have been made with specimens taken from endurance shafts for the purpose of illustrating the tensile properties of the steels used.

In the first set of experiments samples were used 1″ diameter each for the purpose of ascertaining the elastic limits in the same sizes the endurance shafts were employed.

Loads were applied as high as consistent with safety to the threaded ends, and the elongations and sets noted. With the higher carbons the elastic limits were not reached in this manner, and it became necessary to reduce the diameter of the stem, which was done, and the tests resumed.

Loads were applied exceeding the elastic limit and released to observe the rate of recovery or uniformity in the resilience of the metal.

Then, after intervals of rest, the tests were renewed to ascertain whether there had been any recovery in uniformity of elastic properties.

Intervals of rest of one and two months did not, however, effect a recovery, and the curves representing the elongations and recovery under ascending and descending loads continue to follow different paths, and with a variable modulus of elasticity. Observations on the exaltation of the elastic limit will follow on a later occasion.

In the second set of experiments the specimens were turned down in the stems to admit of rupturing the metal without breaking in the thread.

The elastic limits of these specimens follow closely the elastic limits of those in the first series.

These specimens and the annular specimens taken from the outer ends of ruptured endurance shafts afford abundant opportunity to judge of the uniformity of the steel.

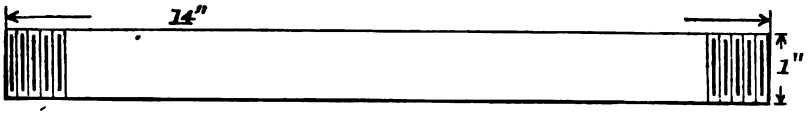
Chemical analyses of 1¼″ Gautier steel bars from which endurance shafts were taken.

Marks.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.	Specific gravity.	Hardness.
	Total.	Graphitic.	Combined.							
1	0.186	0.025	0.161	0.606	0.042	0.067	0.070	0.025	7.8507	11.89
2	0.203	0.031	0.172	0.573	0.040	0.065	0.088	0.030	7.8550	11.75
3	0.384	0.043	0.341	0.652	0.340	0.057	0.048	0.027	7.8340	14.83
5	0.586	0.034	0.552	0.747	0.138	0.050	0.034	0.030	7.8459	21.64
7	0.786	0.053	0.733	0.635	0.035	0.048	0.073	0.027	7.8436	27.82
9	0.866	0.042	0.824	0.361	0.097	0.030	0.043	0.028	7.8321	32.10
11	1.126	0.032	1.094	0.387	0.112	0.042	0.032	0.030	7.8345	31.50

First Set of Experiments.

Elastic limits of seven bars of Gautier steel from outer ends of endurance shafts.

Form of specimens.



No. 5056.

Marks, 209–1 A_2.
Diameter, 1″.000.
Sectional area, .7854 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
785	1,000	0.	0.	Initial load.
3,927	5,000	.0012	0.	
7,854	10,000	.0029	.....	
10,781	15,000	.0048	.....	
15,708	20,000	.0062	—.0001	
19,635	25,000	.0079	.....	
23,562	30,000	.0097	—.0001	
24,347	31,000	.0099	.....	
25,132	32,000	.0102	.....	
25,918	33,000	.0107	.....	
26,703	34,000	.0111	.....	
27,489	35,000	.0114	—.0002	
28,274	36,000	.0117	.....	
29,060	37,000	.0120	.....	
29,845	38,000	.0124	.....	
30,630	39,000	.0128	.....	
31,416	40,000	.0134	.0000	Elastic limit.
32,201	41,000	.0148	.....	
		.0381	.....	Elongation after 5 minutes.
32,986	42,000	.0440	.....	
33,772	43,000	.2480	.2309	
33,772	43,000	.2491	.2329	Second application.
33,772	43,000	.2499	.2332	Third application.
		.2502	.....	Fourth application.
33,772	43,000	.2518	.2350	Elongation after 6 minutes.
33,772	43,000	.2520	.2355	Fifth application.
35,343	45,000	About .26	.....	
36,128	46,000	.29	.....	
36,913	47,000	.33	.....	
37,699	48,000	.36	.....	
38,484	49,000	.38	.....	
39,270	50,000	.42	.....	
40,055	51,000	.45	.....	
40,840	52,000	.50	.....	Test discontinued.

No. 5057.

Marks, 210–2 A_2.
Diameter, 1″.000.
Sectional area, .7854 square inch.
Gauged length, 10″.000.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
785	1,000	0.	0.	Initial load.
3,927	5,000	.0014	0.	
7,854	10,000	.0031	.....	
10,781	15,000	.0050	.....	
15,708	20,000	.0069	0.	
19,635	25,000	.0083	.....	
23,562	30,000	.0102	0.	
23,562	30,000	.0101	.....	Second application.
27,489	35,000	.0118	.....	
28,274	36,000	.0120	.....	
29,060	37,000	.0121	.....	
29,845	38,000	.0123	.....	
30,630	39,000	.0129	.....	Elastic limit. Yielding at threaded ends.
31,416	40,000	.0139	.0002	
32,201	41,000	.0151	.....	
		.0339	.0200	Elongation after 5 minutes.
		.0470	.....	
32,986	42,000	.1713	.1558	Elongation after 15 minutes.
33,772	43,000	.1970	.....	
34,557	44,000	.2040	.....	
35,343	45,000	.2180	.2000	
35,343	45,000	.2201	.2023	Second application. Test discontinued.

No. 5058.

Marks, 211—3 A_1.
Diameter, 1″.000.
Sectional area, .7854 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
785	1,000	0.	0.	Initial load.
3,927	5,000	.0012	0.	
7,854	10,000	.0030	.....	
11,781	15,000	.0046	.....	
15,708	20,000	.0062	.....	
19,635	25,000	.0080	.....	
23,562	30,000	.0095	—.0001	
27,489	35,000	.0112	.....	
31,416	40,000	.0130	—.0001	
34,557	44,000	.0142	.....	
35,343	45,000	.0145	.0000	
36,128	46,000	.0150	.....	
36,913	47,000	.0152	—.0001	
37,699	48,000	.0157	.....	
38,484	49,000	.0161	.0000	Elastic limit.
39,270	50,000	.0170	.....	
		.0179	.0017	Elongation after 5 minutes.
40,055	51,000	.0200	.....	
40,840	52,000	.1590	.1380	
40,840	52,000	.1607	.1402	Second application; test discontinued.

No. 5059.

Marks, 233–5 A 6.
Diameter, 1″.000.
Sectional area, .7854 square inch.
Gauged length, 10.″

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
785	1,000	0.	0.	Initial load.
3,927	5,000	.0014	0.	
7,854	10,000	.0030	.....	
11,781	15,000	.0049	.....	
15,708	20,000	.0064	.....	
19,635	25,000	.0080	.....	
23,562	30,000	.0099	—.0001	
27,489	35,000	.0117	.....	
31,416	40,000	.0132	—.0001	
32,201	41,000	.0136	.....	
32,986	42,000	.0139	.....	
33,772	43,000	.0142	.....	
34,557	44,000	.0147	.....	
35,343	45,000	.0150	—.0001	
36,128	46,000	.0154	.....	
36,913	47,000	.0158	.....	
37,699	48,000	.0161	.....	
38,484	49,000	.0166	.....	
39,270	50,000	.0169	0.	
40,055	51,000	.0172	.....	
40,840	52,000	.0178	.0001	
40,840	52,000	.0178	.0001	Second application.
40,840	52,000	.0178	.0001	Third application. The maximum load was sustained 5 minutes on the second application and 10 minutes on the third application without causing any additional elongation above the immediate effect. Specimen turned down in the stem to ″.798 diameter = .50 square inch sectional area and test resumed after 8 days rest. Gauged length, 10″.
500	1,000	0.	0.	Initial load.
15,000	30,000	.0100	.....	
25,000	50,000	.0169	.....	
27,500	55,000	.0186	.....	
28,000	56,000	.0190	.....	Elastic limit.
28,500	57,000	.0920	.0678	
29,000	58,000	.0955	.....	
29,500	59,000	.0989	.....	
30,000	60,000	.1050	.....	
31,000	62,000	.1179	.....	
32,000	64,000	.1310	.....	
33,000	66,000	.1465	.....	
34,000	68,000	.1612	.....	
35,000	70,000	.17	.....	
36,000	72,000	.19	.....	
37,000	74,000	.20	.....	
38,000	76,000	.22	.....	
39,000	78,000	.24	.....	
40,000	80,000	.27	.....	
41,000	82,000	.29	.....	
42,000	84,000	.31	.....	
43,000	86,000	.34	.....	
44,000	88,000	.37	.....	
45,000	90,000	.40	.....	Micrometer reapplied and adjusted to zero. Gauged length actually 10″.40.
500	1,000	0.	.....	Initial load.
15,000	30,000	.0110	.....	
30,000	60,000	.0250	.....	
15,000	30,000	.0132	.....	
500	1,000	.0001	.....	Test discontinued. Test resumed after resting 1 month. Micrometer adjusted to zero.
500	1,000	0.	.....	
5,000	10,000	.0032	.....	
10,000	20,000	.0070	.....	
15,000	30,000	.0109	.....	
20,000	40,000	.0150	.....	

No. 5059—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
25,000	50,000	.0195	.....	
30,000	60,000	.0241	.....	
25,000	50,000	.0208	.....	
20,000	40,000	.0168	.....	
15,000	30,000	.0127	.....	
10,000	20,000	.0087	.....	
5,000	10,000	.0042	.....	
500	1,000	.0004	.....	
15,000	30,000	.0117	.....	
30,000	60,000	.0242	.....	
15,000	30,000	.0129	.....	
500	1,000	.0004	.....	
15,000	30,000	.0118	.....	
30,000	60,000	.0244	.....	
15,000	30,000	.0128	.....	
500	1,000	.0006	.....	
30,000	60,000	.0247	.....	
35,000	70,000	.0298	.....	
		.0369	.....	
40,000	80,000	.0377	.....	After 8 minutes.
		.0379	.....	After 13 minutes.
		.0417	.....	
42,500	85,000	.0428	.....	After 5 minutes.
40,000	80,000	.0410	.....	
30,000	60,000	.0330	.....	
15,000	30,000	.0199	.....	
500	1,000	.0034	.....	
15,000	30,000	.0149	.....	
30,000	60,000	.0282	.....	
15,000	30,000	.0163	.....	
500	1,000	.0031	.....	Test again discontinued.
				Test resumed after resting 2 months.
500	1,000	0.	.....	
2,500	5,000	.0013	.....	
5,000	10,000	.0032	.....	
7,500	15,000	.0051	.....	
10,000	20,000	.0069	.....	
12,500	25,000	.0088	.....	
15,000	30,000	.0107	.....	
17,500	35,000	.0127	.....	
20,000	40,000	.0147	.....	
22,500	45,000	.0166	.....	
25,000	50,000	.0188	.....	
27,500	55,000	.0211	.....	
30,000	60,000	.0234	.....	
25,000	50,000	.0198	.....	
20,000	40,000	.0159	.....	
15,000	30,000	.0119	.....	
10,000	20,000	.0079	.....	
5,000	10,000	.0038	.....	
2,500	5,000	.0017	.....	
500	1,000	.0001	.....	Test again discontinued.

No. 5060.

Marks, 234–7 A 6.
Diameter, 1″.000.
Sectional area, .7854 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
785	1,000	0.	0.	Initial load.
3,927	5,000	.0012	0.	
7,854	10,000	.0030	.....	
11,781	15,000	.0048	.....	
15,708	20,000	.0062	.....	
19,635	25,000	.0080	.....	
23,562	30,000	.0099	—.0001	
27,489	35,000	.0114	.....	
31,416	40,000	.0130	0.	
35,343	45,000	.0149	.....	
39,270	50,000	.0166	.....	
40,840	52,000	.0171	0.	Stem turned down to ″.798 diameter = .50 square inch sectional area, and test resumed after an interval of 8 days. Gauged length, 10″.
500	1,000	0.	0.	Initial load.
15,000	30,000	.0098	.....	
25,000	50,000	.0164	.....	
27,500	55,000	.0181	0.	
29,000	58,000	.0200	.....	Elastic limit.
29,500	59,000	.0222	.....	
30,000	60,000	.0298	.0079	
31,000	62,000	.0370	.....	
32,000	64,000	.0450	.....	
33,000	66,000	.0529	.....	
34,000	68,000	.0622	.....	
35,000	70,000	.0708	.....	
36,000	72,000	.0809	.....	
37,000	74,000	.0907	.0580	
15,000	30,000	.0689	.....	
30,000	60,000	.0823	.....	
15,000	30,000	.0712	.0582	Test discontinued. Test resumed after resting 1 month. Micrometer adjusted to zero. Actual gauged length, 10 ″.0582.
500	1,000	0.	.....	
10,000	20,000	.0061	.....	
20,000	40,000	.0140	.....	
30,000	60,000	.0232	.....	
20,000	40,000	.0162	.....	
10,000	20,000	.0082	.....	
500	1,000	0.	.....	
10,000	20,000	.0067	.....	
20,000	40,000	.0145	.....	
30,000	60,000	.0232	.....	
20,000	40,000	.0162	.....	
10,000	20,000	.0082	.....	
500	1,000	.0001	.....	
10,000	20,000	.0070	.....	
20,000	40,000	.0149	.....	
30,000	60,000	.0232	.....	
20,000	40,000	.0162	.....	
10,000	20,000	.0084	.....	
500	1,000	.0002	.....	
10,000	20,000	.0070	.....	
20,000	40,000	.0150	.....	
30,000	60,000	.0234	.....	
35,000	70,000	.0301 .0306	.....	After 8 minutes.
30,000	60,000	.0271	.....	
20,000	40,000	.0199	.....	
10,000	20,000	.0112	.....	
500	1,000	.0019	.....	
10,000	20,000	.0086	.....	
20,000	40,000	.0164	.....	
30,000	60,000	.0252	.....	
20,000	40,000	.0182	.....	
10,000	20,000	.0102	.....	
500	1,000	.0020	.....	
2,000	4,000	.....	.....	Rested under this load 16 hours.

No. 5060—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
10,000	20,000	.0085	.....	
20,000	40,000	.0163	.....	
30,000	60,000	.0251	.....	
20,000	40,000	.0180	.....	
10,000	20,000	.0101	.....	
500	1,000	.0020	.....	
10,000	20,000	.0086	.....	
20,000	40,000	.0164	.....	
10,000	20,000	.0092	.....	
500	1,000	.0020	.....	
10,000	20,000	.0086	.....	
20,000	40,000	.0163	.....	
30,000	60,000	.0251	.....	
35,000	70,000	.0310	.....	
36,000	72,000	.0323	.....	
37,000	74,000	.0351	.....	
38,000	76,000	.0417	.....	
39,000	78,000	.0510	.....	
40,000	80,000	.0580	.....	
.....	.....	.0638	.....	After 5 minutes.
.....	.....	.0645	.....	After 10 minutes.
.....	.....	.0650	.....	After 15 minutes.
.....	.....	.0652	.....	After 20 minutes.
.....	.....	.0655	.....	After 25 minutes.
.....	.....	.0658	.....	After 30 minutes.
.....	.....	.0659	.....	After 35 minutes.
.....	.....	.0660	.....	After 40 minutes.
35,000	70,000	.0625	.....	
30,000	60,000	.0589	.....	
20,000	40,000	.0508	.....	
10,000	20,000	.0416	.....	
500	1,000	.0293	.....	
10,000	20,000	.0362	.....	
20,000	40,000	.0442	.....	
30,000	60,000	.0532	.....	
20,000	40,000	.0461	.....	
10,000	20,000	.0382	.....	
500	1,000	.0296	.....	Test discontinued. Test resumed after resting 2 months.
500	1,000	0.	.....	
2,500	5,000	.0011	.....	
5,000	10,000	.0029	.....	
10,000	20,000	.0065	.....	
15,000	30,000	.0103	.....	
20,000	40,000	.0144	.....	
25,000	50,000	.0188	.....	
30,000	60,000	.0238	.....	
25,000	50,000	.0203	.....	
20,000	40,000	.0164	.....	
15,000	30,000	.0125	.....	
10,000	20,000	.0086	.....	
5,000	10,000	.0043	.....	
500	1,000	.0004	.....	
30,000	60,000	.0239	.....	
500	1,000	.0005	.....	
30,000	60,000	.0238	.....	
500	1,000	.0005	.....	Test again discontinued.

No. 5061.

Marks, 235–9 A 6.
Diameter, 1″.000.
Sectional area, .7854 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
785	1,000	0.	0.	Initial load.
3,927	5,000	.0012	0.	
7,854	10,000	.0030	.....	
11,781	15,000	.0048	.....	
15,708	20,000	.0062	.....	
19,635	25,000	.0080	.....	
23,562	30,000	.0099	0.	
27,489	35,000	.0115	.....	
31,416	40,000	.0131	0.	
35,343	45,000	.0150	.....	
39,270	50,000	.0168	0.	
40,840	52,000	.0173	0.	Stem turned down to ″.798 diameter = .50 square inch sectional area. Rested 8 days, then test resumed. Gauged length, 10″.
500	1,000	0.	0.	Initial load.
15,000	30,000	.0098	.....	
25,000	50,000	.0164	.....	
27,500	55,000	.0181	.....	
30,000	60,000	.0200	0.	
32,500	65,000	.0219	.....	
35,000	70,000	.0237	0.	
37,500	75,000	.0254	.....	
39,000	78,000	.0269	.0001	
40,000	80,000	.0278	.0003	Elastic limit.
40,500	81,000	.....	.....	Sustained momentarily, then load fell.
38,500	77,000	.0531	.....	
39,000	78,000	.0650	.....	
39,500	79,000	.1011	.....	
40,000	80,000	.1037	.....	
35,000	70,000	.1002	.....	
25,000	50,000	.0928	.....	
15,000	30,000	.0843	.....	
5,000	10,000	.0739	.0678	
5,000	10,000	.0707	.....	
15,000	30,000	.0781	.....	
25,000	50,000	.0862	.....	
35,000	70,000	.0962	.....	
25,000	50,000	.0893	.....	
15,000	30,000	.0730	.....	
5,000	10,000	.0730	.0681	
5,000	10,000	.0711	.....	
15,000	30,000	.0788	.....	
25,000	50,000	.0869	.....	
35,000	70,000	.0961	.....	
25,000	50,000	.0891	.....	
15,000	30,000	.0815	.....	
5,000	10,000	.0730	.0683	
5,000	10,000	.0713	.....	Rested 40 hours, the load falling from 10,000 to 5,000 pounds per square inch in the meantime.
5,000	10,000	.0712	.0681	
5,000	10,000	.0712	.....	
15,000	30,000	.0784	.....	
25,000	50,000	.0869	.....	
35,000	70,000	.0960	.....	
25,000	50,000	.0890	.....	
15,000	30,000	.0812	.....	
5,000	10,000	.0729	.0684	Test discontinued. Test resumed after resting 1 month. Micrometer reset to zero.
500	1,000	0.	.....	
10,000	20,000	.0050	.....	
20,000	40,000	.0122	.....	
30,000	60,000	.0206	.....	
20,000	40,000	.0138	.....	
10,000	20,000	.0061	.....	
500	1,000	—.0003	.....	
10,000	20,000	.0058	.....	
20,000	40,000	.0131	.....	

No. 5061—Continued.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
30,000	60,000	.0210	.....	
20,000	40,000	.0141	.....	
10,000	20,000	.0068	.....	
500	1,000	—.0002	.....	
10,000	20,000	.0060	.....	
20,000	40,000	.0135	.....	
30,000	60,000	.0211	.....	
20,000	40,000	.0142	.....	
10,000	20,000	.0069	.....	
500	1,000	—.0001	.....	Test again discontinued.
				Test resumed after resting 2 months.
500	1,000	0.	.....	
2,500	5,000	.0010	.....	
5,000	10,000	.0032	.....	
10,000	20,000	.0067	.....	
15,000	30,000	.0103	.....	
20,000	40,000	.0137	.....	
25,000	50,000	.0174	.....	
30,000	60,000	.0212	.....	
25,000	50,000	.0180	.....	
20,000	40,000	.0145	.....	
15,000	30,000	.0111	.....	
10,000	20,000	.0079	.....	
5,000	10,000	.0043	.....	
2,500	5,000	.0024	.....	
500	1,000	.0009	.....	
5,000	10,000	.0036	.....	
15,000	30,000	.0105	.....	
25,000	50,000	.0178	.....	
30,000	60,000	.0214	.....	
25,000	50,000	.0181	.....	
15,000	30,000	.0112	.....	
5,000	10,000	.0038	.....	
500	1,000	.0006	.....	Test again discontinued.

No. 5062.

Marks, 236–11 A 6.
Diameter, 1″.000.
Sectional area, .7854 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
785	1,000	0.	0.	Initial load.
3,927	5,000	.0012	0.	
7,854	10,000	.0031	.....	
11,781	15,000	.0050	.....	
15,708	20,000	.0067	.....	
19,635	25,000	.0081	.....	
23,562	30,000	.0100	0.	
27,489	35,000	.0118	.....	
31,416	40,000	.0132	0.	
35,343	45,000	.0150	.....	
39,270	50,000	.0168	.....	
40,840	52,000	.0173	0.	Stem turned down to ″.798 diameter=.50 square inch sectional area; rested 9 days; then test resumed.
500	1,000	0.	0.	Initial load.
15,000	30,000	.0099	.....	
25,000	50,000	.0169	.....	
15,000	30,000	.0100	—.0002	
27,500	55,000	.0183	.....	
30,000	60,000	.0201	—.0002	
32,500	65,000	.0220	.....	
35,000	70,000	.0239	.....	
25,000	50,000	.0170	.....	
15,000	30,000	.0100	.....	
5,000	10,000	.0030	—.0001	
5,000	10,000	.0030	.....	
15,000	30,000	.0100	.....	
25,000	50,000	.0170	.....	
35,000	70,000	.0240	.....	
36,500	73,000	.0252	.....	Elastic limit; load fell.
34,000	68,000	.0323	.....	
		.0532	.....	Elongation after 5 minutes.
34,500	69,000	.0660	.....	
25,000	50,000	.0599	.....	
15,000	30,000	.0519	.....	
5,000	10,000	.0422	.0370	
5,000	10,000	.0401	.....	
15,000	30,000	.0479	.....	
25,000	50,000	.0560	.....	
15,000	30,000	.0489	.....	Test discontinued.
5,000	10,000	.0410	.0370	The elongation, ″.0660, did not exhaust the stretch of the bar under that load. The load was momentarily applied and released while elongation was in progress. The test was discontinued for two purposes; to ascertain whether there is an exaltation in elastic limit after resting, and to observe the recovery in the modulus of elasticity due to resting.
500	1,000	0.	.....	Test resumed after resting 1 month. Micrometer reset to zero.
5,000	10,000	.0032	.....	
15,000	30,000	.0109	.....	
25,000	50,000	.0190	.....	
15,000	30,000	.0120	.....	
5,000	10,000	.0042	.....	
500	1,000	.0004	.....	
5,000	10,000	.0038	.....	
15,000	30,000	.0110	.....	
500	50,000	.0190	.....	
15,000	30,000	.0119	.....	
5,000	10,000	.0041	.....	
500	1,000	.0004	.....	
5,000	10,000	.0038	.....	
15,000	30,000	.0110	.....	
25,000	50,000	.0190	.....	
		.0190	.....	After 10 minutes.
30,000	60,000	.0240	.....	
		.0242	.....	After 10 minutes.

No. 5062—Continued.

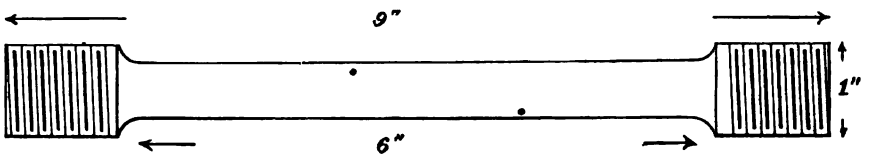
Applied loads.		In gauged lengths.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
25,000	50,000	.0209	.....	
15,000	30,000	.0133	.....	
5,000	10,000	.0052	.....	
500	1,000	.0011	.....	
5,000	10,000	.0042	.....	
15,000	30,000	.0117	.....	
25,000	50,000	.0198	.....	
15,000	30,000	.0126	.....	
5,000	10,000	.0050	.....	
500	1,000	.0011	.....	Test again discontinued.
				Test resumed after resting 2 months.
500	1,000	0.	.....	
2,500	5,000	.0014	.....	
5,000	10,000	.0030	.....	
10,000	20,000	.0065	.....	
15,000	30,000	.0101	.....	
20,000	40,000	.0139	.....	
25,000	50,000	.0180	.....	
30,000	60,000	.0226	.....	
25,000	50,000	.0194	.....	
20,000	40,000	.0159	.....	
15,000	30,000	.0123	.....	
10,000	20,000	.0084	.....	
5,000	10,000	.0044	.....	
2,500	5,000	.0022	.....	
500	1,000	.0005	.....	
30,000	60,000	.0225	.....	
500	1,000	.0010	.....	
30,000	60,000	.0228	.....	
500	1,000	.0009	.....	
30,000	60,000	.0229	.....	
500	1,000	.0011	.....	Test discontinued.

SECOND SET OF EXPERIMENTS.

Tension tests of seven specimens representing the Gautier steel bars used in endurance tests.

Specimens taken from outer ends of ruptured endurance shafts.

Form of specimens.



No. 5063.

Marks, 226–1 A 3.
Diameter, ".564.
Sectional area, .25 square inch.
Gauged length, 6".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0021	.....	
5,000	20,000	.0043	.....	
7,500	30,000	.0063	.0002	
8,750	35,000	.0074	.....	
10,000	40,000	.0085	.0002	
11,250	45,000	.0095	.....	Elastic limit.
11,500	46,000	.0101	.....	
		.1489	.....	
11,750	47,000	.1510	.....	
12,000	48,000	.1630	.....	
12,250	49,000	.1710	.....	
12,500	50,000	.1880	.....	
13,000	52,000	.2200	.....	
13,500	54,000	.2640	.....	
14,000	56,000	.31	.....	
14,500	58,000	.37	.....	
15,000	60,000	.41	.....	
15,500	62,000	.50	.....	
16,000	64,000	.61	.....	
16,500	66,000	.77	.....	
17,000	68,000	1.23	.....	Tensile strength.
0	0	1.58	.....	= 26.3 per cent.

Elongation of inch sections, ".19, "24, ".47*, ".24, ".23, ".21.
Diameter at fracture, ".39. Area, .1194 square inch.
Contraction of area, 52.2 per cent.
Fractured 3" from neck. Appearance, fine silky.

No. 5064.

Marks, 224–2 A 4.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	0.	
2,500	10,000	.0020	.....	
5,000	20,000	.0039	.....	
7,500	30,000	.0059	0.	
8,750	35,000	.0069	.....	
10,000	40,000	.0080	0.	
11,250	45,000	.0090	.....	
11,500	46,000	.0092	.....	
11,750	47,000	.0095	.....	
12,000	48,000	.0098	.....	Elastic limit; load fell.
11,000	44,000	.0500	.....	
11,250	45,000	.1200	.....	
11,500	46,000	.1230	.....	
11,750	47,000	.1290	.....	
12,000	48,000	.1390	.....	
12,500	50,000	.1600	.....	
13,000	52,000	.18	.....	
13,500	54,000	.20	.....	
14,000	56,000	.22	.....	
14,500	58,000	.27	.....	
15,000	60,000	.30	.....	
15,500	62,000	.35	.....	
16,000	64,000	.40	.....	
16,500	66,000	.48	.....	
17,000	68,000	.58	.....	
17,500	70,000	.77	.....	
17,840	71,360	1.16	.....	Tensile strength.
0	0	1.45	.....	= 24.2 per cent.

Elongation of inch sections, ″.18, ″.42 *, ″.27, ″.22, ″.19, ″.17.
Diameter at fracture, ″.40. Area, .1257 square inch.
Contraction of area, 49.7 per cent.
Fractured 2″.5 from neck. Appearance, fine silky.

No. 5065.

Marks, 228–3 A 5.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0008	.....	
2,500	10,000	.0018	.....	
5,000	20,000	.0039	.....	
7,500	30,000	.0060	.....	
10,000	40,000	.0080	0.	
11,250	45,000	.0090	.....	
12,500	50,000	.0101	0.	
13,000	52,000	.0104	.....	Elastic limit.
13,250	53,000	.0140	.....	
.....	.....	.1091	.....	
13,500	54,000	.1140	.....	
13,750	55,000	.1200	.....	
14,000	56,000	.1280	.....	
14,250	57,000	.1350	.....	
14,500	58,000	.1430	.....	
15,000	60,000	.16	.....	
15,500	62,000	.18	.....	
16,000	64,000	.20	.....	
16,500	66,000	.22	.....	
17,000	68,000	.25	.....	
17,500	70,000	.28	.....	
18,000	72,000	.31	.....	
18,500	74,000	.36	.....	
19,000	76,000	.40	.....	
19,500	78,000	.48	.....	
20,000	80,000	.59	.....	
20,500	82,000	.76	.....	
20,730	82,920	1.02	.....	Tensile strength.
0	0	1.44	.....	= 24 per cent.

Elongation of inch sections, ″.17, ″.21, ″.39, ″.31, ″.20, ″.16.
Diameter at fracture, ″.38. Area, .1134 square inch.
Contraction of area, 54.6 per cent.
Fractured 3″.7 from neck. Appearance, fine silky.

No. 5066.

Marks, 222–5 A 4.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0008	0.	
2,500	10,000	.0019	.....	
5,000	20,000	.0040	.....	
7,500	30,000	.0061	0.	
10,000	40,000	.0082	.....	
11,250	45,000	.0092	.....	
12,500	50,000	.0102	0.	
13,750	55,000	.0112	.0001	
14,500	58,000	.0121	.....	Elastic limit.
14,750	59,000	.0578	.....	
15,000	60,000	.0601	.....	
15,250	61,000	.0620	.....	
15,500	62,000	.0659	.....	
16,000	64,000	.0745	.....	
16,500	66,000	.0820	.....	
17,000	68,000	.0912	.....	
17,500	70,000	.0990	.....	
18,000	72,000	.1070	.....	
18,500	74,000	.1180	.....	
19,000	76,000	.1300	.....	
19,500	78,000	.14	.....	
20,000	80,000	.15	.....	
20,500	82,000	.17	.....	
21,000	84,000	.18	.....	
21,500	86,000	.19	.....	
22,000	88,000	.21	.....	
22,500	90,000	.22	.....	
23,000	92,000	.24	.....	
23,500	94,000	.27	.....	
24,000	96,000	.29	.....	
24,500	98,000	.32	.....	
25,000	100,000	.37	.....	
25,500	102,000	.41	.....	
26,000	104,000	.49	.....	
26,500	106,000	.62	.....	
26,820	107,280	.88	.....	Tensile strength.
0	0	1.06	.....	= 17.7 per cent.

Elongation of inch sections, ″.13, ″.25*, ″.24*, .″16, ″.15, ″.13.
Diameter at fracture, ″.45. Area, .1590 square inch.
Contraction of area, 36.4 per cent.
Fractured 2″.4 from neck. Appearance, silky, interspersed with fine granulation.

No. 5067.

Marks, 221–7 A_1.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0008	0.	
2,500	10,000	.0019	.....	
5,000	20,000	.0039	.....	
7,500	30,000	.0059	.....	
10,000	40,000	.0080	0.	
12,500	50,000	.0100	0.	
13,750	55,000	.0110	.....	
14,000	56,000	.0112	.....	
14,250	57,000	.0115	.....	Elastic limit.
14,500	58,000	.0159	.....	
14,750	59,000	.0210	.....	
15,000	60,000	.0242	.....	
15,500	62,000	.0298	.....	
16,000	64,000	.0350	.....	
16,500	66,000	.0410	.....	
17,000	68,000	.0460	.....	
17,500	70,000	.0520	.....	
18,000	72,000	.0580	.....	
18,500	74,000	.0640	.....	
19,000	76,000	.0700	.....	
20,000	80,000	.0830	.....	
21,000	84,000	.0965	.....	
22,000	88,000	.11	.....	
23,000	92,000	.13	.....	
24,000	96,000	.15	.....	
25,000	100,000	.18	.....	
26,000	104,000	.20	.....	
27,000	108,000	.22	.....	
28,000	112,000	.26	.....	
29,000	116,000	.30	.....	
30,000	120,000	.38	.....	
31,000	124,000	.56	.....	
31,080	124,320	.63	.....	Tensile strength.
0	0	.71	.....	=11.8 per cent.

Elongation of inch sections, ″.10, ″.15, ″.17*, ″.10, ″.10, ″.09.
Diamter at fracture, ″.50. Area, .1964 square inch.
Contraction of area, 21.4 per cent.
Fractured 2″.4 from neck. Appearance, granular, radiating from a silky spot at the circumference.

No. 5068.

Marks, 220–9 A_4.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	0.	
2,500	10,000	.0019	.....	
5,000	20,000	.0040	.....	
7,500	30,000	.0060	0.	
10,000	40,000	.0080	.....	
11,250	45,000	.0089	.....	
12,500	50,000	.0100	0.	
13,750	55,000	.0110	0.	
15,000	60,000	.0120	0.	
16,250	65,000	.0131	0.	
17,500	70,000	.0141	0.	
18,750	75,000	.0151	.....	
20,000	80,000	.0161	.....	
20,250	81,000	.0163	.....	
20,500	82,000	.0165	.....	
20,750	83,000	.0168	.....	Elastic limit; load fell.
19,000	76,000	.0220	.....	
19,250	77,000	.0230	.....	
19,500	78,000	.0280	.....	
19,750	79,000	.0440	.....	
20,000	80,000	.0685	.....	
20,500	82,000	.0710	.....	
21,000	84,000	.0750	.....	
21,500	86,000	.0790	.....	
22,000	88,000	.0830	.....	
22,500	90,000	.0893	.....	
24,000	96,000	.10	.....	
25,000	100,000	.11	.....	
26,000	104,000	.12	.....	
27,000	108,000	.13	.....	
28,000	112,000	.16	.....	
29,000	116,000	.18	.....	
30,000	120,000	.20	.....	
31,000	124,000	.22	.....	
32,000	128,000	.25	.....	
33,000	132,000	.29	.....	
33,740	134,960	.....	.....	Tensile strength.
0	0	.24	.....	=4 per cent.

Elongation of inch sections, ″.04, ″.05, ″.04, ″.04, ″.04, ″.03.
Fractured at the neck. Appearance, fine silky.

No. 5069.

Marks, 212–11 A 3.
Diameter, ″.564.
Sectional area, .25 square inch.
Gauged length, 6″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
250	1,000	0.	0.	Initial load.
1,250	5,000	.0009	.....	
2,500	10,000	.0019	.....	
5,000	20,000	.0039	.....	
7,500	30,000	.0059	.....	
10,000	40,000	.0080	.....	
12,500	50,000	.0100	.....	
13,750	55,000	.0110	.....	
15,000	60,000	.0121	.....	
16,250	65,000	.0131	.....	
17,500	70,000	.0143	.....	Elastic limit.
17,750	71,000	.0150	.....	
18,000	72,000	.0160	.....	Load fell.
16,750	67,000	.0207	.....	
17,000	68,000	.0300	.....	
17,250	69,000	.0500	.....	
17,500	70,000	.0512	.....	
17,750	71,000	.0527	.....	
18,000	72,000	.0550	.....	
18,250	73,000	.0570	.....	
18,500	74,000	.0600	.....	
19,000	76,000	.0660	.....	
19,500	78,000	.0718	.....	
20,000	80,000	.0760	.....	
21,000	84,000	.0858	.....	
22,000	88,000	.0980	.....	
23,000	92,000	.1098	.....	
24,000	96,000	.1218	.....	
25,000	100,000	.14	.....	
26,000	104,000	.16	.....	
27,000	108,000	.18	.....	
28,000	112,000	.20	.....	
29,000	116,000	.22	.....	
30,000	120,000	.24	.....	
31,000	124,000	.28	.....	
32,000	128,000	.35	.....	
33,000	132,000	.49	.....	
33,080	132,320	.60	.....	Tensile strength.
0	0	.58	.....	=9.7 per cent.

Elongation of inch sections, ″.10, ″.12*, ″.10, ″.09, ″.09, ″.08.
Diameter at fracture, ″.52. Area, .2124 square inch.
Contraction of area, 15 per cent.
Fractured 1″.6 from neck. Appearance, fine granular, radiating from a point in the circumference.

ENDURANCE OF ROTATING SHAFTS

FROM

GAUTIER STEEL BARS.

THE ENDURANCE TESTS OF ROTATING SHAFTS.

The investigations of previous years are continued in the tests of these shafts, all of which are specimens from a lot of Gautier steel bars originally 1¼″ diameter, and turned down to 1″ diameter for these tests.

The shafts are supported on bearings 33″ apart, and are loaded at the middle on two bearings each ½″ long, and spaced 4″ apart, center to center.

The speed of rotation employed was either 400 or about 1,500 per minute, the details stating which speed was used in individual cases.

The shafts were run at the temperature of the testing laboratory, or at the temperature of 35° F., being kept at these temperatures by means of cold water played on the shaft by several jets, the shaft running partly submerged in a trough which retained part of the water played on the shaft.

Under the higher speed of rotation an envelope of the water was carried around by the shaft and substantially the same cooling effect resulted as though the water level in the trough was above the top element of the shaft.

Some of the shafts were cooled to zero temperature before testing began, and others cooled considerably below the temperature of melting ice, but these shafts if still kept surrounded by the cooling mixture of snow and salt soon reached a temperature of about 30° F., and went higher if the cooling mixture was discontinued.

With present facilities it is impracticable to run a shaft continuously at a temperature below about 35° F.

With a high speed of rotation and under a high fiber stress the quantity of heat developed can be conveniently cared for with ice water, but to maintain a lower temperature some practical difficulties are encountered.

The water carried around with the shafts has a temperature a little above melting ice; cylindrical surfaces of the shafts do not seem to be below 35° F.

One test, No. 272, was made in which the shaft was alternately cooled and allowed to run warm by the application and removal of the cooling fluid.

Attention, with these tests, was chiefly centered on the total number of rotations the different grades of steel would endure under different fiber stresses, and observing whether the range in temperature between about 35° and 70°, or at temperatures not far above atmospheric, would cause a material change in the number of rotations necessary to produce rupture.

If this range in temperature is adequate to cause variations in endurance, the fact is obscured by other causes, as the results show in some cases the shafts run at 70° falling short of and in other cases exceeding the endurance of shafts run at 35°.

Shaft No. 272, of 0.161 carbon steel, tested under conditions of alternate cold and heat, so far exceeded the endurance of other shafts of the same grade of steel as to justify the belief that the higher temperatures to which it was exposed contributed toward increased endurance. The maximum temperature reached by this shaft was 218° F.

When the fiber stresses were 40,000 pounds per square inch and upward, some of the higher carbon shafts showed superior endurance to the softer steels, yet this was not always the case, and examples are shown of the highest carbon steels showing a lower endurance than the milder grades.

When the fiber stresses were 35,000 pounds per square inch, each grade of metal showed a greatly increased endurance over the higher stresses, and under this stress the higher carbons displayed superior results. So abrupt, however, is this increase in the number of repetitions of stresses necessary to produce rupture as to suggest that under certain conditions of loading none of these steels possess the ability to resist, for what could be termed practically an indefinite period, alternate stresses so high as 35,000 pounds per square inch.

The question, which has been so long under discussion, concerning the maximum stress a metal is capable of enduring an indefinite period seems to be left by steel of recent manufacture very near the point that the earliest tests on this subject left it. Such is the case from a general comparison of results.

These tests will be extended to a wider range of material in which maximum tensile strength has been reached by both chemical composition and by mechanical manipulation.

Following the records of the shafts appear the results of tensile tests of annular specimens taken from ruptured shafts. A number of the tests pertain to material reported in the last year's Report of Tests.

These annular specimens were taken one from the middle of the shaft and one from the end. The end specimen was taken in order to have a direct comparison with specimens as near each other as consistent, whereby the changes in properties at the middle, where the greatest bending stress occurred, could be studied.

A table compiled from the endurance tests and the tests of the annular specimens follow these remarks. In the tabulation the loss or gain of the middle specimen over the end one is given.

From thirteen shafts the middle specimens give higher tensile strength and from three shafts lower tensile strength than the end specimens. The latter specimens are supposed to represent the material in its original state.

It has been expected that these annular specimens would indicate some of the phases through which the metal passes prior to rupture, and it appears that data of an interesting nature are here presented.

The fact that so great gains appear in the middle specimens—14,350 and 21,320 pounds per square inch—is believed to show that the metal passes through a maximum stage of resistance when subjected to alternate stresses.

Although we appear to rupture the metal by means of fiber stresses, it may be below the tensile elastic limit of the material, yet before so doing a higher state of tensile resistance is reached than that developed by a test once applied and continued until rupture occurs.

Furthermore, in reaching this advanced tensile strength exhaustion of toughness takes place.

From the results of other experiments on the introduction of internal strains it seems highly probable that internal strains in these endur-

ance shafts may reinforce or augment the external stresses and rupture ensue from the combined effect of internal strains and external stresses.

It would not be expected in case this hypothesis should be found true that all of the annular specimens tested would be in a condition to show the maximum tensile strength attainable in the metal; in fact, occasional specimens only would be met with in these ruptured shafts in which the maximum strength remained.

Incipient cracks had formed in some of the tested annular specimens, and they would necessarily weaken the specimens.

If the metal in these transverse shafts really passes to a maximum resistance above the normal tensile strength, then the tensile strength of the metal would seem to be a function of its resistance to alternate stresses.

The experiments reported in the tests of 1893 showed superior endurance of shafts tested at a temperature approaching a blue heat, and at this temperature it is known that steel possesses a higher tensile strength than at higher or lower temperatures; hence, so far as the evidence of these shafts go, it is consistent with the hypothesis that metals pass to a state of maximum strength, although subsequently ruptured under a stress apparently less than the primitive elastic limit as the latter is defined by the usual tensile test.

So many important questions depend upon the correct explanation and definition of how metals fail under repeated stresses, these investigations will continue using steels differing widely in composition and where mechanical treatment has been carried to a maximum in elevating the physical properties.

RECORD OF ENDURANCE SHAFTS AND ANNULAR TENSION SPECIMENS TAKEN FROM SHAFTS AFTER RUPTURE.

Endurance record.					Tensile record of annular specimens from—				Gain or loss of middle specimen.		Remarks.
					Outer end of shaft.		Middle of shaft.				
No. of test.	Description of metal.	Temperature of test.	Fiber stress per square inch.	Number of rotations.	No. of test.	Tensile strength per square inch.	No. of test.	Tensile strength per square inch.	Gain.	Loss.	
		Degrees F.	*Pounds.*			*Pounds.*		*Pounds.*	*Pounds.*	*Pounds.*	
273	Gautier steel 1 C_1, .161 carbon	35	35,000	763,400	5070	65,610	5071	65,950	340	.....	
243	Gautier steel 1 B_1, .161 carbon	35	40,000	193,050	5072	60,250	5073	63,000	2,750	.....	Surface cracks developed in middle specimen.
230	Gautier steel 1 A_6, .161 carbon	0 to 120	45,000	38,450	5074	60,000	5075	67,930	7,930	.....	
258	Gautier steel 1 B_4, .161 carbon	35	50,000	69,800	5076	62,000	5077	76,350	14,350	.....	
265	Gautier steel 1 B_5, .161 carbon	35	55,000	18,500	5078	65,420	5079	58,420	.....	7,000	Do.
206	Gautier steel 1 A_1, .161 carbon	374	60,000	85,200	5082	62,670	5083	83,990	21,320	.....	Do.
209	Gautier steel 1 A_2, .161 carbon	70	60,000	4,350	5080	62,000	5081	65,400	3,400	.....	
274	Gautier steel 2 B_4, .172 carbon	35	35,000	970,100	5098	71,930	5099	73,950	2,020	.....	
242	Gautier steel 2 B_1, .172 carbon	35	40,000	162,200	5094	71,250	5095	73,540	2,290	.....	Do.
227	Gautier steel 2 A_5, .172 carbon	70	45,000	99,000	5090	75,910	5091	61,880	.....	14,030	Do.
231	Gautier steel 2 A_6, .172 carbon	36	45,000	29,750	5092	69,900	5093	72,280	2,380	.....	
224	Gautier steel 2 A_4, .172 carbon	70	50,000	30,550	5088	74,640	5089	63,760	.....	10,880	Do.
217	Gautier steel 2 A_3, .172 carbon	70	52,460	17,900	5086	72,640	5087	76,240	3,600	.....	Do.
205	Gautier steel 2 A_1, .172 carbon	412	60,000	32,300	5084	69,060	5085	83,010	13,950	.....	Do.
210	Gautier steel 2 A_2, .172 carbon	130	60,000	3,950	5096	70,000	5097	73,440	3,440	.....	Do.
204	Gautier steel 3 A_2, .341 carbon	400	60,000	127,700	5100	88,390	5101	97,760	9,370	.....	

No. 273.

GAUTIER STEEL. MARKS 1 C_1.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.161 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
35,000	0	0	*a*	.2010	.1726	.2008	.0282	.0002	Temperature, 62° F.
			b	.2008	.1730	.2007	.0277	.0001	
			c	.2009	.1728	.2008	.0280	.0001	
									Babbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	141,000	141,000	*a*	.2008	.1725	.2006	.0281	.0002	Rested 15 hours before measurements were taken.
			b	.2009	.1726	.2007	.0281	.0002	
			c	.2010	.1728	.2008	.0280	.0002	Bar cooled to 35° F. before test was resumed.
	150,000	291,000	.....	.....	.....	.....	.....	.....	Rested 15 hours.
	161,500	452,500	.....	.....	.....	.....	.....	.....	Do.
	155,200	607,700	.....	.....	.....	.....	.....	.....	Do.
	139,300	747,000	.....	.....	.....	.....	.....	.....	Do.
	16,400	763,400	.....	.....	.....	.....	.....	.....	Ruptured at north edge of north middle bearing.

No. 243.

GAUTIER STEEL. MARKS 1 B_1.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.161 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2000	.1680	.1998	.0318	.0002	Temperature, 68° F.
			b	.2000	.1675	.1997	.0322	.0003	
			c	.2001	.1674	.1997	.0323	.0004	
									Babbitt boxes used. Bar cooled before test began to 14° F. Run in a trough of water at 35° F., and water at 35° F. played on it.
	108,850	108,850	*a*	.2018	.1682	.1998	.0316	.0020	Bar rested 63 hours before measurements were taken.
			b	.2010	.1676	.1995	.0319	.0015	
			c	.1996	.1664	.1987	.0323	.0009	
									Middle bearings in very good condition. Bar cooled before test was resumed.
	84,200	193,050	.....	.....	.....	.....	.....	.....	Ruptured about $''.10$ from north edge of south middle bearing. Middle bearings in very good condition.

No. 244.

GAUTIER STEEL. MARKS 1 B_2.

Turned down from rod 1¼″ diameter, 0.161 per cent carbon.
Diameter 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.1999	.1683	.1996	.0313	.0003	Temperature, 62° F.
			b	.2000	.1681	.1997	.0316	.0003	
			c	.2003	.1680	.1999	.0319	.0004	
									Babbitt boxes used. Bar cooled before test began to 21° F. Run in a trough of water at 35° F., and water at 35° F. played on it.
	134,650	134,650	*a*	.2004	.1670	.1982	.0312	.0022	Rested 15 hours before measurements were taken.
			b	.2018	.1670	.1987	.0317	.0031	
			c	.2010	.1671	.1989	.0318	.0021	Middle bearings in good condition. Bar cooled before test was resumed.
	35,000	169,650	.....	.....	.....	.....	.....	.....	Ruptured at south edge of south middle bearing. Middle bearings in good condition.

No. 272.

GAUTIER STEEL. MARKS 1 B_G.

Turned down from rod 1¼″ diameter, 0.161 per cent carbon.
Diameter 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Alternate cold and warm test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2001	.1677	.1998	.0321	.0003	
			b	.2003	.1681	.1999	.0318	.0004	
			c	.2005	.1680	.1999	.0319	.0006	
									Bar cooled to 35° F. Snow and ice water bath removed when rotations began, and the temperature of shaft allowed to increase.
	26,900	26,900							Temperature, about 150° F.
									Test arrested and bar again cooled to 35° F. as in the first instance, and after cooling the freezing mixture was removed and rotations resumed.
	31,100	58,000							Temperature, about 150° F.
	15,600	73,600							Test discontinued and shaft again cooled to 35° F.
	34,200	107,800							Temperature, 130° F.
	38,200	146,000							Rested 15 hours, then cooled to 35° F. and test resumed.
	42,000	188,000							Temperature, 152° F.
	42,000	230,000							Bar cooled again to 35° F.
	30,000	260,000							Temperature, 146° F.
									Bar cooled to 35° F.
	51,000	311,000	*a*	.1985	.1660	.1985	.0325	0	Temperature, 140° F.
			b	.2014	.1672	.1995	.0323	.0019	
			c	.2002	.1669	.1992	.0323	.0010	Rested 15 hours.
	39,000	350,000							Stopped and cooled to 35° F.
									Do.
									Rested 41 hours, then cooled to 35° F., and test resumed.
									Temperature, 129° F. Stopped and cooled to 35° F.

53,000	403,000	*a*	.2010	.1670	.1994	.0324	.0016
		b	.1993	.1658	.1985	.0327	.0008
		c	.2007	.1668	.1995	.0327	.0012
24,000	427,000						
23,000	450,000						
49,500	499,500						
43,500	543,000						
24,600	567,600						

Temperature, 181° F.

Cooled to 35° F. and test resumed.

Temperature, 218° F.

Rested 15 hours, then cooled to 35° F. and test resumed.

Temperature, 212° F.

Rotations continued with only sufficient interruption to determine the temperature of shaft.

Temperature, 140° F. Cooled to 35°, F., and test resumed.

Temperature, 185° F. The south section of the middle bearing was rough; scored by deep scratches, apparently.

This bearing was draw filed and test continued, but not all of the scratches were removed by the filing.

Shaft ruptured at the south section of the middle bearing. An annular fracture had extended into the shaft, leaving a cone $\frac{1}{8}$" diameter, which finally completed the rupture.

No. 226.

GAUTIER STEEL. MARKS, 1 A_3.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.161 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Run cold. Stream of water played on shaft during test. Temperature about 70° F.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.2002	.1634	.2000	.0366	.0002	
			b	.2006	.1643	.2002	.0359	.0004	
			c	.2006	.1638	.2002	.0364	.0004	
	5,000	5,000	*a*	.2067	.1591	.1958	.0367	.0109	Bar running cool.
			b	.2040	.1596	.1960	.0364	.0080	
			c	.2038	.1595	.1959	.0364	.0079	
	5,000	10,000	*a*	.2077	.1589	.1957	.0368	.0120	Bar running cool.
			b	.2024	.1587	.1953	.0366	.0071	
			c	.2045	.1588	.1955	.0367	.0090	
	35,600	45,600	.....	.....	.....	.....	.....	.....	Rested without load $16\frac{1}{2}$ hours.
	4,400	50,000	*a*	.1985	.1565	.1933	.0368	.0052	Bar running cold.
			b	.1999	.1580	.1941	.0361	.0058	
			c	.2075	.1589	.1957	.0368	.0118	
	32,950	82,950	.....	.....	.....	.....	.....	.....	Ruptured at the south edge of north middle bearing. Both middle bearings cut some.

No. 230.

GAUTIER STEEL. MARKS, 1 As.

Turned down from rod 1¼″ diameter, 0.161 per cent carbon.
Diameter, 1″. Speed of rotation 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Run cold. Stream of water played on shaft during test.]

Maximum fiber stress, per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.1998	.1634	.1996	.0362	.0002	
			b	.2002	.1640	.2000	.0360	.0002	
			c	.2002	.1637	.1998	.0361	.0004	Bar now packed in mixture of snow and salt, allowed to rest ½ hour, then rotations began. Temperature of snow and salt, 0° F. The bar during the time it was running was kept covered with the snow and salt. The freezing mixture covered 20″ length of bar.
	5,100	5,100	*a*	.2085	.1682	.2040	.0358	.0045	The snow and salt found inadequate to keep the bar cool; the middle part of the shaft had attained a temperature of about 120° F. and both middle bearings were cut.
			b	.1990	.1621	.1978	.0357	.0012	
			c	.1965	.1594	.1950	.0356	.0015	While running, the freezing mixture was constantly fed against the shaft, notwithstanding which the bar heated. Rested 4 hours without load, then remeasured. Temperature, 70° F.
	0	5,100	*a*	.2061	.1678	.2039	.0361	.0022	
			b	.1996	.1608	.1971	.0363	.0025	
			c	.1966	.1591	.1951	.0360	.0015	Bar packed in freezing mixture of snow and salt, and after 1 hour again measured. Temperature of bar, about 8° F.
	0	5,100	*a*	.2060	.1685	.2039	.0354	.0021	
			b	.1998	.1622	.1977	.0355	.0021	
			c	.1968	.1596	.1955	.0359	.0013	

No. 230—Continued.

Maximum fiber stress, per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
	0	5,100	*a*	.2055	.1685	.2040	.0355	.0015	Temperature of bar, about 55° F.
			b	.1995	.1621	.1978	.0357	.0017	
			c	.1966	.1600	.1955	.0355	.0011	
	0	5,100	*a*	.2054	.1672	.2033	.0361	.0021	Shaft warmed by means of an alcohol lamp to about 100° F.
			b	.1996	.1614	.1974	.0360	.0022	
			c	.1967	.1596	.1954	.0358	.0013	
									Shaft packed in freezing mixture and remained there one hour.
	0	5100	*a*	.2056	.1676	.2035	.0359	.0021	Temperature of bar, about 12° F.
			b	.1999	.1618	.1977	.0359	.0022	
			c	.1966	.1595	.1953	.0358	.0013	

A tank of snow and salt and water was provided, and cold water from this tank played on the shaft while running. The shaft was run partly submerged in a trough of the water which was played on it, the water being collected in the trough until overflow occurred.

When the shaft began to run the temperature of the water in the trough was 34° F. At 15,000 rotations the tank water was delivered on the shaft at 30° F.

At 38,450 rotations bar ruptured under the south middle bearing.

So far as could be judged the fracture was more sudden than in the case of warmer bars; that is, there was no premonitory signs of approaching rupture, as shown by the wabbling of the shaft and the consequent vibrations of the weighted lever.

The temperature of the bar was about 35° F. during the last 23,000 rotations.

The tendency to heat was so pronounced that the water, if colder when applied, rose to about 35° on contact with the shaft.

Using a mixture of snow and salt in the trough enabled a temperature of 20° F. to be maintained within $\frac{1}{4}''$ of the shaft, but the water immediately in contact with the shaft stood at 35° F. as above remarked.

The scoring of the bearing doubtless contributed to the early rupture of the shaft.

No. 251.

GAUTIER STEEL. MARKS, 1 B_3.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.161 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.,
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold Test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.1991	.1636	.1989	.0353	.0002	Temperature, 72° F.
			b	.1992	.1630	.1986	.0356	.0006	
			c	.1997	.1632	.1990	.0358	.0007	
	0	0	*a*	.1995	.1632	.1986	.0354	.0009	Measurements repeated.
			b	.1994	.1630	.1986	.0356	.0008	
			c	.1997	.1632	.1990	.0358	.0007	
									Babbitt boxes used. Bar cooled before test began to 32° F. Run in a trough of water at 35° F., and water at 35° F. played on it.
	38,000	38,000	*a*	.1940	.1580	.1936	.0356	.0004	Rested 16 hours before measurements were taken.
			b	.1980	.1590	.1946	.0356	.0034	
			c	.2056	.1604	.1956	.0352	.0100	
									Middle bearings in good condition.
									Bar cooled before test was resumed.
	111,600	149,600	.....	.....	.....	.....	.....	.....	Ruptured at the south edge of south middle bearing. Middle bearings in good condition.

No. 225.

GAUTIER STEEL. MARKS, 1 A.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.161 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Run cold. Stream of water played on shaft during test. Temperature, about 70° F.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
50,000	0	0	*a*	.2003	.1600	.2000	.0400	.0003	
			b	.2004	.1601	.2000	.0399	.0004	
			c	.2006	.1601	.2002	.0401	.0004	
	5,000	5,000	*a*	.2194	.1452	.1870	.0418	.0324	Both middle bearings slightly warm.
			b	.2137	.1470	.1879	.0409	.0258	
			c	.2105	.1461	.1868	.0407	.0237	
	5,000	10,000	*a*	.2236	.1487	.1892	.0405	.0344	
			b	.2025	.1444	.1850	.0406	.0175	
			c	.2128	.1465	.1877	.0412	.0251	
			a	.2125	.1611	.2015	.0404	.0110	Measurements repeated after an interval of rest without load.
			b	.2048	.1554	.1945	.0391	.0103	
			c	.1975	.1486	.1886	.0400	.0089	
	19,950	29,950	.....	.....	.....	.....	.....	.....	Ruptured in the north middle bearing.

No. 258.

GAUTIER STEEL. MARKS, 1 B_4.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.161 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
50,000	0	0	*a*	.2004	.1597	.1997	.0400	.0007	Temperature, 72° F.
			b	.2002	.1597	.1994	.0397	.0008	
			c	.2005	.1605	.1994	.0389	.0001	Babbitt boxes used. Bar cooled before test began to 35° F. Run in a trough of water at 35° F., and water at 35° F. played on it.
	22,000	22,000	.....	.....	.....	.....	.....	.....	Rested 40 hours.
	47,800	69,800	.....	.....	.....	.....	.....	.....	Ruptured at the north edge of south middle bearing. Middle bearings in good condition.

No. 218.

GAUTIER STEEL. MARKS, 1 A_5.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.161 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Run cold. Stream of water played on shaft during test. Temperature, about 70° F.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
52,460	0	0	*a*	.2002	.1585	.1998	.0413	.0004	
			b	.2007	.1584	.2000	.0416	.0007	
			c	.2008	.1581	.2001	.0420	.0007	
	5,000	5,000	*a*	.2248	.1390	.1822	.0432	.0426	
			b	.1915	.1330	.1754	.0424	.0161	
			c	.2265	.1435	.1860	.0425	.0405	
	5,000	10,000	*a*	.2273	.1395	.1831	.0436	.0442	
			b	.1964	.1315	.1749	.0434	.0215	
			c	.2250	.1405	.1832	.0427	.0418	
	4,800	14,800	.....	.....	.....	.....	.....	.....	Bar ruptured in north middle bearing, which was warmer than south bearing; temperature about 90° F.

No. 265.

GAUTIER STEEL. MARKS, 1 B_g.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.161 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
55,000	0	0	*a*	.2004	.1560	.1996	.0436	.0008	Temperature, 60° F.
			b	.2006	.1560	.1995	.0435	.0011	
			c	.2011	.1554	.1990	.0436	.0021	Babbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	18,500	18,500							Ruptured under south middle bearing. Middle bearings in good condition.

No. 274.

GAUTIER STEEL. MARKS, 2 B_4.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.172 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
35,000	0	0	*a*	.2003	.1723	.2002	.0279	.0001	
			b	.1998	.1717	.1996	.0279	.0002	
			c	.2000	.1722	.1998	.0276	.0002	Babbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	98,700	98,700							Rested 39 hours.
	137,300	236,000							Rested 15 hours.
	156,000	392,000							Do.
	156,600	548,600							Do.
	146,400	695,000							Do.
	148,700	843,700							Do.
	126,400	970,100							Ruptured at north edge of south middle bearing.

No. 242.

GAUTIER STEEL. MARKS, 2 B_1

Turned down from rod $1\frac{1}{4}''$ diameter, 0.172 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2000	.1683	.1998	.0315	.0002	Temperature, 70° F.
			b	.1999	.1686	.1996	.0310	.0003	
			c	.1998	.1679	.1995	.0316	.0003	Babbitt boxes used. Bar cooled before test began to 30° F. Run in a trough of water at 35° F., and water at 35° F. played on it.
	52,100	52,100	*a*	.2040	.1652	.1967	.0315	.0073	Bar rested 15 hours before measurements were taken.
			b	.2015	.1646	.1964	.0318	.0051	
			c	.2025	.1645	.1965	.0320	.0060	South middle bearing in good condition; score line on north bearing. Bar cooled before test was resumed.
	110,100	162,200	.....	.....	.....	.....	.....	.....	Ruptured about ″.15 from north edge of north middle bearing. Bearings in good condition.

No. 245.

GAUTIER STEEL. MARKS, 2 B_2.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.172 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.1997	.1178	.1995	.0317	.0002	Temperature, 73° F.
			b	.1996	.1680	.1994	.0314	.0002	
			c	.1998	.1092	.1995	.0303	.0003	
	0	0	*a*	.1998	.1678	.1995	.0317	.0003	Measurements repeated.
			b	.1995	.1675	.1993	.0318	.0002	
			c	.1998	.1692	.1995	.0303	.0003	
									Babbitt boxes used. Bar cooled before test began to 23° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	76,550	76,550	*a*	.2036	.1640	.1961	.0321	.0075	Rested 15 hours before measurements were taken.
			b	.2021	.1649	.1966	.0317	.0055	
			c	.2020	.1654	.1965	.0311	.0055	
									Bar cooled before test was resumed.
	35,300	111,850							Ruptured about ".10 from the south edge of north middle bearing. Middle bearings in good condition.

No. 227.

GAUTIER STEEL. MARKS, $2A_5$.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.172 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Run cold. Stream of water played on shaft during test. Temperature, about 70° F.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.2000	.1641	.1998	.0357	.0002	
			b	.1999	.1638	.1995	.0357	.0004	
			c	.2003	.1645	.2000	.0355	.0003	
	5,000	5,000	*a*	.2126	.1549	.1915	.0366	.0211	
			b	.2014	.1533	.1898	.0365	.0116	
			c	.2090	.1561	.1925	.0364	.0165	
	5,000	10,000	*a*	.1920	.1510	.1875	.0365	.0045	Bar running cold.
			b	.1980	.1516	.1880	.0364	.0100	
			c	.2143	.1564	.1930	.0366	.0213	
	40,000	50,000	*a*	.1897	.1511	.1880	.0369	.0017	
			b	.2002	.1518	.1889	.0371	.0113	
			c	.2136	.1562	.1933	.0371	.0197	
									Rested without load 16 hours.
	0	50,000	*a*	.2055	.1555	.1924	.0369	.0131	
			b	.2062	.1547	.1915	.0368	.0147	
			c	.2077	.1569	.1936	.0367	.0141	
	49,000	99,000	.....	.....	.....	.....	.....	.....	Ruptured $1''.1$ inside the south middle bearing.

No. 231.

GAUTIER STEEL. MARKS, 2 A_G.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.172 per cent carbon.
Diameter $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.2004	.1652	.2002	.0350	.0002	Temperature, 65° F.
			b	.2005	.1646	.2002	.0356	.0003	
			c	.2004	.1645	.2000	.0355	.0004	Run in trough partly submerged in snow and salt water, temperature being about 36° F. Bar cooled before test began.
	10,000	10,000	*a*	.1972	.1553	.1906	.0353	.0066	
			b	.2122	.1550	.1918	.0368	.0204	
			c	.2070	.1551	.1915	.0364	.0155	
	19,750	29,750	.....	.....	.....	.....	.....	.....	Ruptured at edge of north middle bearing. The bearing was in very good condition at the close of the test.

No. 252.

GAUTIER STEEL. MARKS, 2 B_3.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.172 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.1996	.1640	.1995	.0355	.0001	Temperature, 71° F.
			b	.2000	.1641	.1998	.0357	.0002	
			c	.1996	.1649	.1994	.0345	.0002	
	0	0	*a*	.1998	.1642	.1995	.0353	.0003	Measurements repeated after 16 hours' rest.
			b	.2002	.1645	.1998	.0353	.0004	
			c	.2001	.1646	.2000	.0354	.0001	
									Babbitt boxes used. Bar cooled before test began to 30° F. Run in a trough of water at 35° F., and water at 35° F. played on it.
	77,900	77,900	.....	.....	.....	.....	.....	.....	Ruptured about ″.05 from the north edge of south middle bearing. Middle bearings in good condition.

No. 224.

GAUTIER STEEL. MARKS, 2 A_4.

Turned down from rod 1¼ diameter, 0.172 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Run cold. Stream of water played on shaft during test. Temperature, about 70° F.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
50,000	0	0	*a*	.1995	.1598	.1992	.0394	.0003	
			b	.2002	.1605	.1998	.0393	.0004	
			c	.1998	.1604	.1993	.0389	.0005	
	2,500	2,500	.....	.....	.....	.....	.....	.....	Rested without load ½ hour.
	2,500	5,000	*a*	.2073	.1380	.1794	.0414	.0279	Temperature at bearings, about 80° F.
			b	.1926	.1371	.1770	.0399	.0156	
			c	.2248	.1461	.1864	.0403	.0384	
	5,000	10,000	*a*	.1740	.1271	.1684	.0413	.0056	Temperature at south middle bearing about 90° F.; north bearing cooler.
			b	.2217	.1421	.1829	.0408	.0388	
			c	.2218	.1460	.1868	.0408	.0350	
	20,550	30,550	.....	.....	.....	.....	.....	.....	Ruptured at north edge of north middle bearing, which was cold. The south bearing had a temperature of about 90° F.

No. 259.

GAUTIER STEEL. MARKS, 2 B_6.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.172 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
50,000	0	0	*a*	.2001	.1602	.1998	.0396	.0003	Temperature, 72° F.
			b	.2002	.1600	.1998	.0398	.0004	
			c	.2002	.1599	.1997	.0398	.0005	Babbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	89,600	89,600	.....	.....	.....	.....	.....	.....	Ruptured at the south edge of north middle bearing. Middle bearings in good condition.

No. 217.

GAUTIER STEEL. MARKS, 2 A_3.

Turned down from rod 1¼″ diameter, 0.172 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Run cold. Stream of water played on shaft during test. Temperature, about 70° F.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
52,460	0	0	*a*	.2005	.1587	.2002	.0415	.0003	
			b	.1999	.1580	.1995	.0415	.0004	
			c	.2002	.1585	.1998	.0413	.0004	
	5,000	5,000	*a*	.2020	.1254	.1691	.0437	.0329	
			b	.1940	.1270	.1691	.0421	.0249	
			c	.2340	.1380	.1806	.0426	.0534	
	5,000	10,000	*a*	.1665	.1159	.1597	.0438	.0068	
			b	.2267	.1365	.1793	.0428	.0474	
			c	.2270	.1395	.1820	.0425	.0450	
	7,900	17,900	.....	.....	.....	.....	.....	.....	Temperature, from 70° to 80° F. Bar ruptured at south edge of south middle bearing, which run warmer than north bearing.

No. 266.

GAUTIER STEEL. MARKS, 2 B_5.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.172 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
55,000	0	0	*a*	.2003	.1561	.1996	.0435	.0007	Temperature, 65° F.
			b	.2001	.1560	.1997	.0437	.0004	
			c	.2004	.1563	.1999	.0436	.0005	
									Babbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	161,000	161,000	.....	.....	.....	.....	.....	.....	Ruptured under north middle bearing. Cracked in several places between middle bearings. Middle bearings in good condition.

No. 275.

GAUTIER STEEL. MARKS, 3 B_4.

Turned down from rod 1¼″ diameter, 0.341 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
35,000	0	0	*a*	.2005	.1726	.2004	.0278	.0001	
			b	.2004	.1727	.2003	.0275	.0002	
			c	.2002	.1725	.2001	.0276	.0001	
									Babbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	146,300	146,300							Rested 15 hours.
	6,151,700	6,298,000							Do.
	0	6,298,000	*a*	.2005	.1724	.2003	.0279	.0002	
			b	.2003	.1722	.2002	.0280	.0001	
			c	.2004	.1722	.2001	.0279	.0003	
	92,000	6,390,000							Speed increased to 1,500 rotations per minute.
	5,040,000	11,430,000							Middle bearings of shaft reduced by wear to ″.9960 diameter. Rested 17 hours.
	518,200	11,948,200							The use of snow discontinued. Water continued to be played on the shaft, the temperature of which was about 70° F. Rested 39 hours.
	2,145,200	14,093,000							Ruptured at south edge of south middle bearing. The shaft rested at intervals of 150,000 to 180,000 rotations before the speed was increased to 1,500 per minute. After this the rests occurred at intervals of about 600,000 rotations. The rests were from 15 to 40 hours duration.

No. 241.

GAUTIER STEEL. MARKS, 3 B_1.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.341 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.1998	.1686	.1996	.0310	.0002	Temperature, 61° F.
			b	.1999	.1687	.1997	.0310	.0002	
			c	.1999	.1687	.1996	.0309	.0003	
									Babbitt boxes used. Bar cooled before test began to 20° F. Run in a trough of water at 35° F., and water at 35° F. played on it.
	128,750	128,750	*a*	.1994	.1674	.1990	.0316	.0004	Rested without load 15 hours before measurements were taken.
			b	.2003	.1679	.1992	.0313	.0011	
			c	.2004	.1678	.1993	.0315	.0011	
									Middle bearings in good condition. Bar cooled before test was resumed.
	145,150	273,900	*a*	.1997	.1675	.1993	.0318	.0004	Rested without load 15 hours before measurements were taken.
			b	.2004	.1678	.1994	.0316	.0010	
			c	.2003	.1676	.1991	.0315	.0012	North middle bearing in good condition. South bearing has a score line in the middle of bearing.
	43,200	317,100	.....	.....	.....	.....	.....	.....	Ruptured at the north edge of south middle bearing. Bearings in good condition.

No. 246.

GAUTIER STEEL. MARKS, 3 B_2.

Turned down from rod 1¼″ diameter, 0.341 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.1999	.1675	.1997	.0322	.0002	Temperature, 64° F.
			b	.1998	.1677	.1996	.0319	.0002	
			c	.1999	.1675	.1996	.0321	.0003	Babbitt boxes used. Bar cooled before test began to 24° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	122,250	122,250	*a*	.2001	.1677	.1993	.0316	.0008	Rested 40 hours before measurements were taken.
			b	.2002	.1675	.1992	.0317	.0010	
			c	.2002	.1674	.1993	.0319	.0009	Middle bearings in very good condition. Bar cooled before test was resumed.
	113,900	236,150	.....	.....	.....	.....	.....	.....	Ruptured at the north edge of south middle bearing. Middle bearings in very good condition.

No. 228.

GAUTIER STEEL. MARKS, 3 A_5.

Turned down from rod 1¼″ diameter, 0.341 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Run cold. Stream of water played on shaft during test. Temperature, about 70° F.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.2001	.1645	.2000	.0355	.0001	
			b	.2005	.1650	.2002	.0352	.0003	
			c	.2005	.1646	.2002	.0356	.0003	
	5,000	5,000	*a*	.2000	.1619	.1979	.0360	.0021	
			b	.2000	.1619	.1979	.0360	.0021	
			c	.2030	.1632	.1989	.0357	.0041	
	5,000	10,000	*a*	.2017	.1624	.1984	.0360	.0033	
			b	.1999	.1620	.1980	.0360	.0019	
			c	.2028	.1630	.1990	.0360	.0038	
	0	10,000	*a*	.2017	.1630	.1987	.0357	.0030	Rested without load 21 hours.
			b	.2013	.1629	.1985	.0356	.0028	
			c	.2020	.1632	.1990	.0358	.0030	
	40,000	50,000	*a*	.2023	.1626	.1987	.0361	.0036	Bar running cold.
			b	.2007	.1626	.1986	.0360	.0021	
			c	.2017	.1633	.1990	.0357	.0027	
	6,600	56,600							Rested without load 52 hours.
	45,400	102,000	*a*	.2016	.1627	.1986	.0359	.0030	Rested 24 hours without load before measurements were taken.
			b	.2016	.1633	.1986	.0353	.0030	
			c	.2016	.1632	.1990	.0358	.0026	

No. 228—Continued.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
	25,500	127,500							Rested 16 hours without load.
	62,500	190,000							North middle bearing began to cut.
	10,000	200,000	*a*	.2010	.1625	.1982	.0357	.0028	Bar running cold.
			b	.2000	.1620	.1981	.0361	.0019	
			c	.2023	.1630	.1990	.0360	.0034	
	19,100	219,100							Rested without load 17 hours.
	2,900	222,000							Rested without load 5 days, 23 hours.
	78,000	300,000	*a*	.2020	.1624	.1985	.0361	.0035	
			b	.2005	.1622	.1984	.0362	.0021	
			c	.2019	.1629	.1990	.0361	.0029	
	35,300	335,300							Rested without load 45 hours.
	19,450	354,750							Ruptured ".45 outside south middle bearing. Both middle bearings slightly cut.

No. 232.

GAUTIER STEEL. MARKS, 3 A_6.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.341 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.2000	.1641	.1978	.0357	.0002	Temperature, 68° F.
			b	.2000	.1645	.1997	.0352	.0003	
			c	.1998	.1638	.1995	.0357	.0003	Run in trough of water at 35° F. with stream of cold water 35° F. playing on it. Bar cooled before test began.
	10,000	10,000	*a*	.2022	.1630	.1984	.0354	.0038	
			b	.2010	.1630	.1985	.0355	.0025	
			c	.2010	.1629	.1982	.0352	.0028	
									Middle bearings in very good condition.
	71,900	81,900	.....	.....	.....	.....	.....	.....	Ruptured at the south edge of north middle bearing. Bearings a little rough.

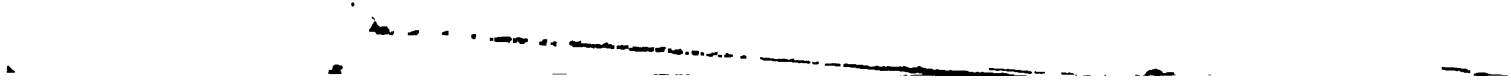
No. 253.

GAUTIER STEEL. MARKS, 3 B_3.

Turned down from rod 1¼″ diameter, 0.341 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.1995	.1636	.1993	.0357	.0002	Temperature, 70° F.
			b	.1999	.1639	.1995	.0356	.0004	
			c	.1999	.1643	.1995	.0352	.0004	Babbitt boxes used. Bar cooled before test began to 30° F. Run in a trough of water at 35° F., and water at 35° F. played on it.
	11,200	11,200	*a*	.2010	.1624	.1980	.0356	.0030	Rested 16 hours before measurements were taken.
			b	.1997	.1621	.1979	.0358	.0018	
			c	.2011	.1627	.1981	.0354	.0030	Middle bearings in good condition.
	138,400	149,600	.....	.....	.....	.....	.....	.....	Ruptured about ″.05 from north edge of south middle bearing. Middle bearings in good condition.



No. 260.

GAUTIER STEEL. MARKS, 3 B_6.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.341 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
50,000	0	0	*a*	.2004	.1607	.2001	.0394	.0003	Temperature, 60° F.
			b	.2004	.1601	.1999	.0398	.0005	
			c	.2004	.1602	.2000	.0398	.0004	Babbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	105,300	105,300	.....	.....	.....	.....	.....	.....	Ruptured about $\frac{1}{2}''$ inside south middle bearing. Middle bearings in good condition.

No. 216.

GAUTIER STEEL. MARKS, 3 A_4.

Turned down from rod 1¼″ diameter, 0.341 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Run cold. Stream of water played on shaft during test. Temperature, about 70° F.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
52,460	0	0	*a*	.2001	.1580	.1998	.0418	.0003	
			b	.2005	.1584	.2000	.0416	.0005	
			c	.2009	.1588	.2003	.0415	.0006	
	5,000	5,000	*a*	.1935	.1482	.1904	.0422	.0031	
			b	.2108	.1521	.1946	.0425	.0162	
			c	.2066	.1523	.1943	.0420	.0123	
	5,000	10,000	*a*	.1912	.1477	.1900	.0423	.0012	North side of south middle bearing cut slightly.
			b	.2014	.1508	.1932	.0424	.0082	
			c	.2092	.1521	.1945	.0424	.0147	
	40,000	50,000	*a*	.1997	.1484	.1915	.0431	.0082	
			b	.1990	.1495	.1925	.0430	.0065	
			c	.2094	.1513	.1945	.0432	.0149	
	17,950	67,950	.....	.....	.....	.....	.....	.....	Bar ruptured at the south middle bearing.

No. 267.

GAUTIER STEEL. MARKS, 3 B_5.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.341 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
55,000	0	0	*a*	.2004	.1565	.2000	.0435	.0004	Temperature, 68° F.
			b	.2002	.1558	.1998	.0440	.0004	
			c	.2003	.1558	.1998	.0440	.0005	Babbit boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	63,300	63,300	.....	.....	.....	.....	.....	.....	Ruptured under south middle bearing. Middle bearings in good condition.

No. 276.

GAUTIER STEEL. MARKS, 5 B_5.

Turned down from rod 1½″ diameter, 0.552 per cent carbon.
Diameter, 1″. Speed of rotation, 1,500 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
35,000	0	0	*a*	.2000	.1721	.1999	.0278	.0001	
			b	.2000	.1727	.2000	.0273	0	
			c	.1999	.1723	.1999	.0276	0	
	535,000	535,000							Rested 15 hours.
	719,800	1,254,800							Do.
	767,900	2,022,700							Rested 17 days.
	563,800	2,586,500							Rested 15 hours.
	637,600	3,224,100							Rested 39 hours.
	400,300	3,624,400							Ruptured at north edge of south middle bearing.

No. 247.

GAUTIER STEEL. MARKS, 5 B_1.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.552 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2009	.1689	.2007	.0318	.0002	Temperature, 70° F.
			b	.2003	.1680	.2001	.0321	.0002	
			c	.2007	.1683	.2005	.0322	.0002	Babbitt boxes used. Bar cooled before test began to 23° F. Run in a trough of water at 35° F., and water at 35° F. played on it.
	10,400	10,400	*a*	.2025	.1680	.1995	.0315	.0030	Rested 15 hours before measurements were taken.
			b	.2014	.1666	.1988	.0322	.0026	
			c	.2018	.1667	.1991	.0324	.0027	Middle bearings in good condition. Bar cooled before test was resumed.
	130,800	141,200	*a*	.2024	.1657	.1981	.0324	.0043	Rested 16 hours before measurements were taken.
			b	.2022	.1651	.1976	.0325	.0046	
			c	.2037	.1654	.1982	.0328	.0055	Middle bearings in good condition.
	19,300	160,500	.....	.....	.....	.....	.....	.....	Ruptured about ″.20 from the south edge of south middle bearing. Middle bearings in good condition.

No. 240.

GAUTIER STEEL. MARKS, 5 B_3.

Turned down from rod 1¼″ diameter, 0.552 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2000	.1681	.1998	.0317	.0002	Temperature, 60° F.
			b	.2003	.1688	.2001	.0313	.0002	
			c	.2004	.1690	.2002	.0312	.0002	Babbitt boxes used. Bar cooled before test began to 16° F. Run in a trough of water at 35° F., and water at 35° F. played on it.
	16,700	16,700	*a*	.1985	.1667	.1983	.0316	.0002	Bar rested without load 15 hours before measurements were taken.
			b	.2014	.1668	.1987	.0319	.0027	
			c	.2014	.1670	.1989	.0319	.0025	Middle bearings in very good condition. Bar cooled before test was resumed.
	136,800	153,500							Ruptured at south edge of south middle bearing. Middle bearings in very good condition. No traces of scoring on either bearing.

No. 229.

GAUTIER STEEL. MARKS, 5 A_5.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.552 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Run cold. Stream of water played on shaft during test. Temperature, about 70° F.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.2002	.1643	.2001	.0358	.0001	
			b	.2000	.1638	.1998	.0360	.0002	
			c	.2003	.1641	.2001	.0360	.0002	
	5,000	5,000	*a*	.2034	.1604	.1970	.0366	.0064	Rested 24 hours without load before measurements were taken.
			b	.1998	.1598	.1963	.0365	.0035	
			c	.2031	.1606	.1974	.0368	.0057	
	5,000	10,000	*a*	.2050	.1601	.1969	.0368	.0081	Bar again rested 24 hours without load; test then resumed.
			b	.2020	.1596	.1963	.0367	.0057	
			c	.2030	.1600	.1969	.0369	.0061	
	40,000	50,000	*a*	.2000	.1578	.1953	.0375	.0047	
			b	.1990	.1578	.1949	.0371	.0041	
			c	.2053	.1596	.1968	.0372	.0085	
	47,250	97,250	.....	.....	.....	.....	.....	.....	Ruptured about ".4 inside the south middle bearing. South bearing warm, north bearing cold. There was a tool mark scored on the surface of this bar when fracture occurred, and doubtless influenced the endurance.

No. 233.

GAUTIER STEEL. MARKS, 5 A_6.

Turned down from rod 1¼″ diameter, 0.552 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.2000	.1643	.1999	.0356	.0001	Temperature, 67° F.
			b	.1998	.1645	.1996	.0351	.0002	
			c	.2002	.1645	.2001	.0356	.0001	Run in trough of water at 35° F., with stream of water at 35° F. playing on it. Bar cooled before test began.
	86,350	86,350	.....	.....	.....	.....	.....	.....	Ruptured at the north edge of north middle bearing. Both middle bearings in fair condition.

No. 254.

GAUTIER STEEL. MARKS, 5 B_3.

Turned down from rod 1¼″ diameter, 0.552 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.2005	.1650	.2004	.0354	.0001	Temperature, 61° F.
			b	.2005	.1649	.2003	.0354	.0002	
			c	.2005	.1645	.2003	.0358	.0002	Babbitt boxes used. Bar cooled before test began to 32° F. Run in a trough of water at 35° F., and water at 35° F. played on it.
	81,250	81,250	.....	.....	.....	.....	.....	.....	Ruptured at the north edge of south middle bearing. Middle bearings in good condition.

No. 261.

GAUTIER STEEL. MARKS, 5 B_4.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.552 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
50,000	0	0	*a*	.1998	.1596	.1994	.0398	.0004	Temperature, 68° F.
			b	.1998	.1596	.1995	.0399	.0003	
			c	.1999	.1603	.1997	.0394	.0002	Babbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	12,300	12,300							Rested 16 hours.
	55,400	67,700							Ruptured under the north middle bearing. Middle bearings in good condition.

No. 222.

GAUTIER STEEL. MARKS, 5 A_4.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.552 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Run cold. Stream of water played on shaft during test. Temperature, about 70° F.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
50,000	0	0	*a*	.2000	.1606	.1996	.0390	.0004	
			b	.2000	.1600	.1998	.0398	.0002	
			c	.1996	.1598	.1994	.0396	.0002	
	5,000	5,000	*a*	.1976	.1507	.1919	.0412	.0057	
			b	.2082	.1530	.1941	.0411	.0141	
			c	.2052	.1524	.1938	.0414	.0114	
	5,000	10,000	*a*	.2085	.1520	.1934	.0414	.0151	
			b	.2050	.1526	.1935	.0409	.0115	
			c	.2051	.1524	.1935	.0411	.0116	
	40,000	50,000	*a*	.2067	.1510	.1926	.0416	.0141	Temperature at north middle bearing, about 75° F.
			b	.2065	.1517	.1933	.0416	.0132	
			c	.2054	.1513	.1933	.0420	.0121	
	46,750	96,750	.....	.....	.....	.....	.....	.....	Temperature at bearings, about 85° F. Rested without load $16\frac{1}{2}$ hours.
	1,050	97,800	.....	.....	.....	.....	.....	.....	Bar ruptured in north middle bearing.

No. 268.

GAUTIER STEEL. MARKS, 5 B.

Turned down from rod 1¼″ diameter, 0.552 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
55,000	0	0	*a*	.2001	.1559	.1999	.0440	.0002	Temperature, 59° F.
			b	.2000	.1559	.1998	.0439	.0002	
			c	.2001	.1562	.1997	.0435	.0004	Babbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	37,700	37,700	.....	.....	.....	.....	.....	.....	Ruptured at north edge of south middle bearing. Middle bearings in good condition.

No. 277.

GAUTIER STEEL. MARKS, 7 B_G.

Turned down from rod $1\frac{1}{2}''$ diameter, 0.733 per cent carbon.
Diameter, $1''$. Speed of rotation, 1,500 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
35,000	0	0	*a*	.2017	.1737	.2017	.0280	0.	
			b	.2018	.1736	.2017	.0281	.0001	
			c	.2015	.1739	.2015	.0276	0.	
	144,100	144,100	.....	.....	.....	.....	.....	.....	Rested 15 hours.
	315,100	459,200	*a*	.2017	.1738	.2017	.0279	0.	
			b	.2019	.1738	.2017	.0279	.0002	
			c	.2016	.1738	.2016	.0278	0.	
	339,800	799,000	.....	.....	.....	.....	.....	.....	Rested 15 hours.
	14,490,100	15,289,100	.....	.....	.....	.....	.....	.....	Shaft ruptured.
									The shaft rested at intervals of about 700,000 rotations each.

No. 239.

GAUTIER STEEL. MARKS, 7 A$_5$.

Turned down from rod 1¼″ diameter, 0.733 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test].

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2000	.1680	.1999	.0319	.0001	Temperature, 65° F.
			b	.1998	.1683	.1998	.0315	0.	
			c	.1996	.1681	.1995	.0314	.0001	Bar cooled before test began to 16° F. Run in a trough of water at 35° F., and water at 35° F. played on it.
	10,000	10,000	*a*	.2001	.1684	.2000	.0316	.0001	
			b	.1998	.1679	.1997	.0318	.0001	
			c	.1995	.1676	.1995	.0319	0.	
	102,600	112,600	*a*	.2000	.1681	.1999	.0318	.0001	Rested without load 15 hours before measurements were taken.
			b	.1998	.1680	.1998	.0318	0.	
			c	.1995	.1680	.1995	.0315	0.	
	35,400	148,000	.....	.....	.....	.....	.....	.....	Fine scored lines under middle bearings. Ruptured at south edge of south middle bearing.

No. 248.

GAUTIER STEEL. MARKS, 7 B_3.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.733 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.1996	.1683	.1995	.0312	.0001	Temperature, 70° F
			b	.2001	.1684	.2000	.0316	.0001	
			c	.2002	.1682	.2001	.0319	.0001	
	0	0	*a*	.1997	.1682	.1995	.0313	.0002	
			b	.2001	.1685	.2000	.0315	.0001	
			c	.2002	.1681	.2001	.0320	.0001	Babbitt boxes used. Bar cooled before test began to 24° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	63,300	63,300	*a*	.1994	.1680	.1994	.0314	0.	Rested 16 hours before measurements were taken.
			b	.2000	.1681	.2000	.0319	0.	
			c	.2002	.1683	.2001	.0318	.0001	
	126,950	190,250	*a*	.1995	.1681	.1995	.0314	0.	
			b	.2002	.1681	.2001	.0320	.0001	
			c	.2002	.1681	.2002	.0321	0.	
	146,850	337,100	*a*	.1997	.1678	.1996	.0318	.0001	Middle bearings in good condition.
			b	.2003	.1683	.2003	.0320	0.	
			c	.2003	.1680	.2003	.0323	0.	
									Middle bearings in good condition. Bar cooled before test was resumed.
	116,800	453,900	.....	.....	.....	.....	.....	.....	Ruptured at north edge of south middle bearing. Middle bearings in good condition.

No. 234.

GAUTIER STEEL. MARKS 7 A_6.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.733 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.2003	.1646	.2002	.0356	.0001	Temperature, 60° F.
			b	.2003	.1644	.2002	.0358	.0001	
			c	.2003	.1647	.2001	.0354	.0002	Bar cooled before test began to 30° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	10,000	10,000	*a*	.2005	.1649	.2002	.0353	.0003	
			b	.2003	.1652	.2000	.0348	.0003	
			c	.2003	.1644	.2001	.0357	.0002	
									Middle bearings in very good condition.
	116,450	126,450	.....	.....	.....	.....	.....	.....	Rested 15 hours. Bar cooled before test was resumed.
	50,200	176,650	.....	.....	.....	.....	.....	.....	Ruptured at the south edge of south middle bearing. Both middle bearings in very good condition, but worn below the surface of the shaft, reducing the diameter of the shaft ″.0012.

No. 257.

GAUTIER STEEL. MARKS, 7 B_g.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.733 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.2018	.1664	.2016	.0352	.0002	Temperature, 64° F.
			b	.2014	.1653	.2013	.0360	.0001	
			c	.2014	.1655	.2013	.0358	.0001	Babbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	148,000	148,000	*a*	.2020	.1664	.2016	.0352	.0004	
			b	.2014	.1650	.2012	.0362	.0002	
			c	.2015	.1649	.2012	.0363	.0003	Rested 16 hours.
	96,000	244,000	.....	.....	.....	.....	.....	.....	Ruptured at the middle of south middle bearing. Middle bearings in good condition.

No. 221.

GAUTIER STEEL. MARKS, 7 A_4.

Turned down from rod 1¼″ diameter, 0.733 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Run cold. Stream of water played on shaft during test. Temperature, about 70° F.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
50,000	0	0	*a*	.2005	.1605	.2004	.0399	.0001	
			b	.2000	.1599	.1999	.0400	.0001	
			c	.2002	.1603	.2000	.0397	.0002	
	5,000	5,000	*a*	.1993	.1591	.1990	.0399	.0003	
			b	.2007	.1588	.1990	.0402	.0017	
			c	.2011	.1587	.1990	.0403	.0021	
	5,000	10,000	*a*	.2007	.1585	.1995	.0410	.0012	Running straight and very cool.
			b	.1998	.1589	.1988	.0399	.0010	Temperature about 75° F.
			c	.2013	.1587	.1990	.0403	.0023	
	36,000	46,000	.....	.....	.....	.....	.....	.....	Rested without load ½ hour.
	4,000	50,000	*a*	.1991	.1583	.1989	.0406	.0002	Running cool and straight.
			b	.2009	.1580	.1989	.0409	.0020	
			c	.2012	.1581	.1989	.0408	.0023	
	25,000	75,000	.....	.....	.....	.....	.....	.....	Running cool.
	25,000	100,000	*a*	.1998	.1586	.1993	.0407	.0005	
			b	.2012	.1583	.1990	.0407	.0022	
			c	.2008	.1578	.1989	.0411	.0019	Rested without load 41 hours.
	0	100,000	*a*	.2014	.1589	.1998	.0409	.0016	

No. 262.

GAUTIER STEEL. MARKS, 7 B_4.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.733 per cent carbon.
Diameter 1''. Speed of rotation, 400 per minute.
Length between end bearings, 33''.
Loaded over 4'' length at middle.
Deflections measured on chord of 10''.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
50,000	0	0	*a*	.2009	.1607	.2007	.0400	.0002	Temperature, 73° F.
			b	.2013	.1614	.2010	.0396	.0003	
			c	.2012	.1608	.2009	.0401	.0003	Babbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	64,000	64,000	*a*	.2010	.1604	.2006	.0402	.0004	Rested 16 hours before measurements were taken.
			b	.2013	.1605	.2008	.0403	.0005	
			c	.2013	.1602	.2006	.0404	.0007	Bar cooled to 35° F.
	62,000	126,000	.....	.....	.....	.....	.....	.....	Ruptured under the north middle bearing. Middle bearings in good condition.

No. 269.

GAUTIER STEEL. MARKS, 7 B_2.

Turned down from rod 1¼″ diameter, 0.733 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
55,000	0	0	*a*	.1994	.1553	.1993	.0440	.0001	Temperature, 70° F.
			b	.1997	.1557	.1997	.0440	0.	
			c	.2001	.1561	.1999	.0438	.0002	Babbit boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	96,500	96,500	.....	.....	.....	.....	.....	.....	Rested 16 hours.
									Bar cooled to 35° F. before test was resumed.
	20,500	117,000	.....	.....	.....	.....	.....	.....	Ruptured at south edge of north middle bearing. Middle bearings in good condition.

...iddle bearing. Middle
...very good condition.

No. 249.

GAUTIER STEEL. MARKS, 9 B_1.

Turned down from rod 1¼″ diameter, 0.824 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.			*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.1990	.1668	.1990	.0322	0.	Temperature, 58° F.
			b	.1991	.1678	.1990	.0312	.0001	
			c	.1990	.1669	.1989	.0320	.0001	Babbitt boxes used. Bar cooled before test began to 14° F. Run in a trough of water at 35° F., and water at 35° F. played on it.
	103,500	103,500	*a*	.1990	.1669	.1989	.0320	.0001	Rested 16 hours before measurements were taken.
			b	.1991	.1676	.1990	.0314	.0001	
			c	.1990	.1673	.1989	.0316	.0001	Middle bearings in good condition. Bar cooled before test was resumed.
	124,950	228,450	*a*	.1990	.1669	.1990	.0321	0.	Rested 16 hours before measurements were taken.
			b	.1991	.1676	.1990	.0314	.0001	
			c	.1990	.1670	.1989	.0319	.0001	Middle bearings in good condition. Bar cooled before test was resumed.
	116,350	344,800	*a*	.1990	.1675	.1989	.0314	.0001	Rested 16 hours before measurements were taken.
			b	.1991	.1674	.1990	.0316	.0001	
			c	.1990	.1668	.1990	.0322	0.	Middle bearings in good condition. Bar cooled before test was resumed.
	61,800	406,600	*a*	.1990	.1670	.1990	.0320	0.	Rested 16 hours before measurements were taken.
			b	.1991	.1672	.1990	.0318	.0001	
			c	.1991	.1668	.1990	.0322	.0001	Middle bearings in good condition. Bar cooled before test was resumed.
	74,700	481,300	.....	.....	.....	.....	.....	.....	Ruptured about ″. 10 from south edge of north middle bearing. Middle bearings in good condition.

No. 235.

GAUTIER STEEL. MARKS, 9 A_6.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.824 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.2007	.1649	.2005	.0356	.0002	Temperature, 70° F.
			b	.2004	.1645	.2003	.0358	.0001	
			c	.2006	.1646	.2004	.0358	.0002	Bar cooled before test began to 30° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	10,000	10,000	*a*	.2010	.1651	.2005	.0354	.0005	
			b	.2004	.1643	.2000	.0357	.0004	
			c	.2007	.1645	.2002	.0357	.0005	
	31,000	41,000	*a*	.2007	.1648	.2004	.0356	.0003	Rested without load 15 hours before measurements were taken.
			b	.2009	.1643	.2002	.0359	.0007	
			c	.2008	.1645	.2002	.0357	.0006	Bar cooled and test resumed. Middle bearings in good condition.
	133,400	174,400	.....	.....	.....	.....	.....	.....	Ruptured at south edge of south middle bearing. Middle bearings in goood condition.

No 255.

GAUTIER STEEL. MARKS, 9 B_2.

Turned down from rod, 1¼″ diameter, 0.824 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.2001	.1644	.2000	.0356	.0001	Temperature, 72° F.
			b	.1999	.1640	.1998	.0358	.0001	
			c	.1998	.1639	.1997	.0358	.0001	Babbitt boxes used. Bar cooled before test began to 18° F. Run in a trough of water at 35° F., and water at 35° F. played on it.
	11,500	11,500	*a*	.2001	.1643	.2000	.0357	.0001	Rested 16 hours before measurements were taken.
			b	.2000	.1635	.1997	.0362	.0003	
			c	.2000	.1645	.1997	.0352	.0003	Middle bearings in good condition.
	146,800	158,300							Rested 16 hours.
	31,700	190,000							Ruptured at north edge of south middle bearing. Middle bearings in good condition.

No. 263.

GAUTIER STEEL. MARKS, 9 B_5.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.824 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
50,000	0	0	*a*	.2003	.1604	.2001	.0397	.0002	Temperature 69° F.
			b	.2007	.1613	.2006	.0393	.0001	
			c	.2004	.1603	.2003	.0400	.0001	Babbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	63,300	63,300	*a*	.1995	.1590	.1995	.0405	0.	Rested 16 hours before measurements were taken.
			b	.2010	.1597	.2000	.0403	.0010	
			c	.2008	.1589	.1996	.0407	.0012	Bar cooled to 35° F.
	150,700	214,000	*a*	.2009	.1588	.1996	.0408	.0013	Rested 16 hours before measurements were taken.
			b	.2006	.1593	.1999	.0406	.0007	
			c	.2010	.1593	.1997	.0404	.0013	Bar cooled to 35° F.
	100,600	314,600	.....	.....	.....	.....	.....	.....	Ruptured under the north middle bearing. Middle bearings in good condition.

No. 213.

GAUTIER STEEL. MARKS, 9 A_3.

Turned down from rod $1\frac{1}{4}''$ diameter, 0.824 per cent carbon.
Diameter, $1''$. Speed of rotation, 400 per minute.
Length between end bearings, $33''$.
Loaded over $4''$ length at middle.
Deflections measured on chord of $10''$.

[Ran cold. Stream of water played on shaft during test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
52,460	0	0	*a*	.2005	.1585	.2002	.0417	.0003	
			b	.2004	.1581	.2001	.0420	.0003	
			c	.2005	.1585	.2003	.0418	.0002	
	5,000	5,000	*a*	.1995	.1554	.1980	.0426	.0015	
			b	.2004	.1558	.1985	.0427	.0019	
			c	.2027	.1577	.1990	.0413	.0037	
	5,000	10,000	*a*	.2007	.1556	.1984	.0428	.0023	
			b	.2027	.1560	.1989	.0429	.0038	
			c	.2015	.1558	.1985	.0427	.0030	
	10,400	20,400	.....	.....	.....	.....	.....	.....	Bar rested without load 30 hours.
	20,600	50,000	*a*	.1983	.1550	.1978	.0428	.0005	
			b	.2003	.1558	.1985	.0427	.0018	
			c	.2030	.1566	.1988	.0422	.0042	
	40,700	90,700	.....	.....	.....	.....	.....	.....	Bar rested without load 1 hour.
	9,300	100,000	*a*	.1985	.1548	.1979	.0431	.0006	
			b	.2006	.1555	.1985	.0430	.0021	
			c	.2028	.1552	.1986	.0434	.0042	
	16,500	116,500	.....	.....	.....	.....	.....	.....	Bar ruptured at north middle bearing. Temperature of bar was about 90° F. during the test.

No. 270.

GAUTIER STEEL. MARKS, 9 B_3.

Turned down from rod 1¼″ diameter, 0.824 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
55,000	0	0	*a*	.2005	.1564	.2003	.0439	.0002	Temperature, 69° F.
			b	.2006	.1560	.2004	.0444	.0002	
			c	.2006	.1560	.2003	.0443	.0003	Babbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	100,300	100,300	.....	.....	.....	.....	.....	.....	Ruptured under north middle bearing. Middle bearings in good condition.

No. 237.

GAUTIER STEEL. MARKS, 11 A_5.

Turned down from rod $1\frac{1}{4}''$ diameter, 1.094 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.1992	.1677	.1990	.0313	.0002	Temperature, 68° F.
			b	.1994	.1683	.1993	.0310	.0001	
			c	.1999	.1688	.1998	.0310	.0001	Bar cooled before test began to about 30° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	55,950	55,950	.....	.....	.....	.....	.....	.....	Rested without load 16 hours.
	106,450	162,400	.....	.....	.....	.....	.....	.....	Ruptured at the south edge of south middle bearing. Middle bearings in fair condition.

No. 250.

GAUTIER STEEL. MARKS, 11 B_1.

Turned down from rod 1¼″ diameter, 1.094 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
40,000	0	0	*a*	.2002	.1682	.2001	.0319	.0001	Temperature, 71° F.
			b	.2000	.1681	.2000	.0319	0.	
			c	.2003	.1680	.2002	.0322	.0001	Babbitt boxes used. Bar cooled before test began. Run in a trough of water at 35° F., and water at 35° F. played on it.
	16,000	16,000	*a*	.2003	.1681	.2001	.0320	.0002	Rested 16 hours before measurements were taken.
			b	.2000	.1679	.1999	.0320	.0001	
			c	.2003	.1681	.2002	.0321	.0001	Middle bearings in good condition.
									Bar cooled before test was resumed.
	127,950	143,950	*a*	.2004	.1682	.2002	.0320	.0002	Rested 40 hours before measurements were taken.
			b	.2003	.1674	.1999	.0325	.0004	
			c	.2003	.1678	.2001	.0323	.0002	Middle bearings in good condition.
									Bar cooled before test was resumed.
	143,950	287,900	*a*	.2000	.1681	.1999	.0318	.0001	Rested 16 hours before measurements were taken.
			b	.2004	.1674	.1998	.0324	.0006	
			c	.2004	.1678	.2000	.0322	.0004	Middle bearings in good condition.
									Bar cooled before test was resumed.
	132,000	420,000	*a*	.2005	.1681	.2000	.0319	.0005	Rested 16 hours before measurements were taken.
			b	.2001	.1675	.1998	.0323	.0003	
			c	.2004	.1680	.2000	.0320	.0004	Middle bearings in good condition.
									Bar cooled before test was resumed.
	46,350	466,350	.....	.....	.....	.....	.....	.....	Ruptured about ″.05 from the north edge of south middle bearing. Middle bearings in good condition.

No. 256.

GAUTIER STEEL. MARKS, 11 B_2.

Turned down from rod $1\frac{1}{4}''$ diameter, 1.094 per cent carbon.
Diameter, 1''. Speed of rotation, 400 per minute.
Length between end bearings, 33''.
Loaded over 4'' length at middle.
Deflections measured on chord of 10''.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
45,000	0	0	*a*	.2004	.1642	.2002	.0360	.0002	Temperature, 72° F.
			b	.2007	.1644	.2004	.0360	.0003	
			c	.2004	.1654	.2003	.0349	.0001	
									Rabbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	68,800	68,800	*a*	.2010	.1624	.1990	.0386	.0020	Rested 16 hours before measurements were taken.
			b	.2011	.1627	.1994	.0367	.0017	
			c	.2013	.1623	.1990	.0367	.0023	
	32,700	101,500	.....	.....	.....	.....	.....	.....	Ruptured at north edge of north middle bearing. Middle bearings in good condition.

No. 219.

GAUTIER STEEL. MARKS, 11 A_4.

Turned down from rod 1¼″ diameter, 1.094 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Run cold. Stream of water played on shaft during test. Temperature, about 70° F.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
50,000	0	0	*a*	.2005	.1602	.2004	.0402	.0001	
			b	.2004	.1602	.2004	.0402	0.	
			c	.2003	.1600	.2002	.0402	.0001	
	5,000	5,000	*a*	.1954	.1544	.1950	.0406	.0004	Rested ½ hour before measurements were taken without load.
			b	.2023	.1559	.1970	.0411	.0053	
			c	.2045	.1558	.1972	.0414	.0073	
	5,000	10,000	*a*	.2004	.1540	.1955	.0415	.0049	Running very cool.
			b	.2056	.1558	.1972	.0414	.0084	
			c	.2032	.1545	.1962	.0417	.0070	
	40,000	50,000	*a*	.1934	.1508	.1927	.0419	.0007	
			b	.2043	.1539	.1959	.0420	.0084	
			c	.2061	.1539	.1960	.0421	.0101	
	7,200	57,200	.....	.....	.....	.....	.....	.....	Rested 17 hours without load.
	42,800	100,000	*a*	.1950	.1527	.1940	.0413	.0010	
			b	.2056	.1541	.1964	.0423	.0092	
			c	.2049	.1540	.1960	.0420	.0089	
	50,000	150,000	.....	.....	.....	.....	.....	.....	Rested 1 hour without load. Bar running very cool. Temperature, about 80° F.
	9,550	159,550	.....	.....	.....	.....	.....	.....	Bar ruptured about half way between north and south middle bearings.

No. 264.

GAUTIER STEEL. MARKS, 11 B_6.

Turned down from rod $1\frac{1}{4}''$ diameter, 1.094 per cent carbon.
Diameter, 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
50,000	0	0	*a*	.2015	.1610	.2013	.0403	.0002	Temperature, 72° F.
			b	.2017	.1613	.2014	.0401	.0003	
			c	.2018	.1617	.2015	.0398	.0003	
									Babbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	23,000	23,000							Rested 40 hours.
									Bar cooled to 35° F. before test was resumed.
	107,100	130,100							Ruptured under the north middle bearing. Middle bearings in good condition.

No. 271.

GAUTIER STEEL. MARKS, 11 B_3.

Turned down from rod $1\frac{1}{4}''$ diameter, 1.094 per cent carbon.
Diameter 1″. Speed of rotation, 400 per minute.
Length between end bearings, 33″.
Loaded over 4″ length at middle.
Deflections measured on chord of 10″.

[Cold test.]

Maximum fiber stress per square inch.	Number of rotations.		Micrometer readings for deflections.				Deflections.	Sets.	Remarks.
	Successive.	Total.	On line.	Unloaded.	Loaded.	Unloaded.			
Pounds.				*Inch.*	*Inch.*	*Inch.*	*Inch.*	*Inch.*	
55,000	0	0	*a*	.2014	.1578	.2011	.0433	.0003	Temperature, 64° F.
			b	.2016	.1574	.2014	.0440	.0002	
			c	.2015	.1573	.2012	.0439	.0003	
									Babbitt boxes used. Bar cooled before test began to 35° F. Run in trough of water at 35° F., and water at 35° F. played on it.
	48,300	48,300	.....	.....	.....	.....	.....	.....	Ruptured at the south edge of north middle bearing. Middle bearings in good condition.

ENDURANCE OF ROTATING SHAFTS.

SUMMARIZED TABULATION.

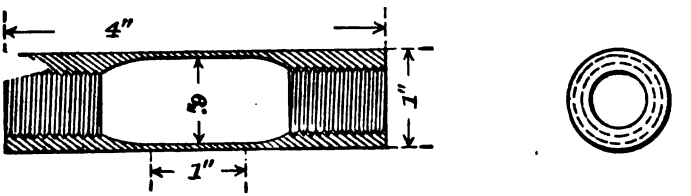
No of test.	Material.	Marks.	Carbon.	Speed of rotation per minute.	Temperature of test.	Maximum fiber stress per square inch.	Total number of rotations.	Remarks.
			Per cent.		*Degrees, F.*	*Pounds.*		
273	Gautier steel	1 C_1	0.161	400	35	35,000	763,400	Shaft ruptured at north middle bearing.
243	.....do	1 B_1	0.161	400	35	40,000	193,050	Shaft ruptured ".10 inside middle bearing.
244	.....do	1 B_2	0.161	400	35	40,000	169,650	Shaft ruptured at south middle bearing.
272	.....do	1 B_3	0.161	400	Alternate. 35 and 218	40,000	567,600	Shaft ruptured at south middle bearing. Maximum temperature
226	.... do	1 A_3	0.161	400	70	45,000	82,950	Shaft ruptured at north middle bearing.
230	.....do	1 A_4	0.161	400	0 to 120	45,000	38,450	Shaft ruptured under south middle bearing. Maximum tempering test, 120° F.
251	.....do	1 B_3	0.161	400	35	45,000	149,650	Shaft ruptured at south middle bearing.
225	.....do	1 A_4	0.161	400	70	50,000	29,950	Shaft ruptured at north middle bearing.
258	.....do	1 B_4	0.161	400	35	50,000	69,800	Shaft ruptured at south middle bearing.
218	.....do	1 A_5	0.161	400	70	52,460	14,800	Shaft ruptured in north middle bearing. Maximum temperature, a
265	.....do	1 B_5	0.161	400	35	55,000	18,500	Shaft ruptured under south middle bearing.
274	.....do	2 B_4	0.172	400	35	35,000	970,100	Shaft ruptured at south middle bearing.
242	.....do	2 B_1	0.172	400	35	40,000	162,200	Shaft ruptured about ".15 outside the north middle bearing.
245	.....do	2 B_2	0.172	400	35	40.000	111,850	Ruptured about ".10 inside the north middle bearing.
227	.....do	2 A_3	0.172	400	70	45.000	99,000	Ruptured 1".1 inside the south middle bearing.
231	.....do	2 A_4	0.172	400	36	45,000	29,750	Ruptured at edge of north middle bearing.
252	.....do	2 B_3	0.172	400	35	45,000	77,900	Ruptured about ".05 inside south middle bearing.
224	.....do	2 A_4	0.172	400	70	50.000	30,550	Ruptured at north middle bearing.
259	.....do	2 B_4	0.172	400	35	50,000	89,600	Do.
217	.....do	2 A_5	0.172	400	70	52,460	17,900	Ruptured at south middle bearing. Temperature, 70° to 80° F.
266	.....do	2 B_5	0.172	400	35	55,000	161,000	Ruptured under north middle bearing.
275	.....do	3 B_4	0.341	400	35 and 70	35,000	14,093,000	Ruptured at south middle bearing.
241	.....do	3 B_1	0.341	400	35	40,000	317,100	Do.
246	.....do	3 B_2	0.341	400	35	40,000	236,150	Do.
228	.....do	3 A_3	0.341	400	70	45,000	854,750	Ruptured ".45 outside south middle bearing.
232	.....do	3 A_4	0.341	400	35	45,000	81,900	Ruptured at north middle bearing.
253	.....do	3 B_3	0.341	400	35	45,000	149,600	Ruptured ".05 inside south middle bearing.
223	.....do	3 A_3	0.341	400	70	50,000	90,150	Ruptured at south middle bearing.
260	.....do	3 B_3	0.341	400	35	50,000	105,300	Ruptured ".50 inside south middle bearing.
216	.....do	3 A_4	0.341	400	70	52,460	67,950	Ruptured at south middle bearing.
267	.....do	3 B_5	0.341	400	35	55,000	63,300	Ruptured under south middle bearing.
276	.....do	5 B_5	0.552	1,500	70	35,000	3,624,400	Ruptured at south middle bearing.
247	.....do	5 B_1	0.552	400	35	40,000	160,500	Ruptured ".20 outside south middle bearing.

SUMMARIZED TABULATION—Continued.

No. of test.	Material.	Marks.	Carbon.	Speed of rotation per minute.	Temperature of test.	Maximum fiber stress per square inch.	Total number of rotations.	Remarks.
			Per cent.		*Degrees, F.*	*Pounds.*		
240	Gautier steel.....	5 B_2	0.552	400	35	40,000	153,500	Ruptured at south middle bearing.
229	.....do.....	5 A_6	0.552	400	70	45,000	97,250	Ruptured about ".4 inside the south middle bearing.
233	.....do.....	5 A_6	0.552	400	35	45,000	86,350	Ruptured at north middle bearing.
254	.....do.....	5 B_2	0.552	400	35	45,000	81,250	Do.
261	.....do.....	5 B_4	0.552	400	35	50,000	67,700	Ruptured under north middle bearing.
222	.....do.....	5 A_4	0.552	400	70	50,000	97,800	Ruptured in north middle bearing. Temperature, about 85° F.
215	.....do.....	5 A_3	0.552	400	70	52,460	43,650	Ruptured at north middle bearing.
268	.....do.....	5 B_6	0.552	400	35	55,000	37,700	Ruptured at south middle bearing.
277	.....do.....	7 B_6	0.733	1,500	70	35,000	15,289,100	Ruptured.
239	.....do.....	7 A_5	0.733	400	35	40,000	148,000	Ruptured at south middle bearing.
248	.....do.....	7 B_2	0.733	400	35	40,000	453,900	Do.
234	.....do.....	7 A_6	0.733	400	35	45,000	176,650	Do.
257	.....do.....	7 B_5	0.733	400	35	45,000	244,000	Do.
221	.....do.....	7 A_4	0.733	400	70	50,000	287,700	Do.
262	.....do.....	7 B_4	0.733	400	35	50,000	126,000	Ruptured under north middle bearing.
214	.....do.....	7 A_3	0.733	400	68	52,460	92,350	Ruptured in north middle bearing.
269	.....do.....	7 B_3	0.733	400	35	55,000	117,000	Ruptured at north middle bearing.
238	.....do.....	9 A_6	0.824	400	35	40,000	269,500	Ruptured at south middle bearing.
249	.....do.....	9 B_1	0.824	400	35	40,000	481,300	Ruptured ".10 inside north middle bearing.
235	.....do.....	9 A_6	0.824	400	35	45,000	174,400	Ruptured at south middle bearing.
255	.....do.....	9 B_2	0.824	400	35	45,000	190,000	Do.
220	.....do.....	9 A_4	0.824	400	70	50,000	103,100	Ruptured in north middle bearing.
263	.....do.....	9 B_5	0.824	400	35	50,000	314,600	Ruptured on north middle bearing.
213	.....do.....	9 A_3	0.824	400	90	52,460	116,500	Ruptured at north middle bearing. Temperature of shaft, about 90° F. during test.
270	.....do.....	9 B_3	0.824	400	35	55,000	100,300	Ruptured under north middle bearing.
237	.....do.....	11 A_5	1.094	400	35	40,000	162,400	Ruptured at south middle bearing.
250	.....do.....	11 B_1	1.094	400	35	40,000	466,350	Ruptured about ".05 inside south middle bearing.
236	.....do.....	11 A_6	1.094	400	35	45,000	81,150	Ruptured at north middle bearing.
256	.....do.....	11 B_2	1.094	400	35	45,000	101,500	Do.
219	.....do.....	11 A_4	1.094	400	70	50,000	159,550	Ruptured about midway north and south middle bearings. Temperature of shaft, about 80° F.
264	.....do.....	11 B_6	1.094	400	35	50,000	130,100	Ruptured under the north middle bearing.
212	.....do.....	11 A_3	1.094	400	70	52,460	29,500	Ruptured at north middle bearing.
271	.....do.....	11 B_3	1.094	400	35	55,000	48,300	Do.

TENSION TESTS OF ANNULAR SPECIMENS FROM RUPTURED ENDURANCE SHAFTS.

Form of specimens.



Material from Gautier steel, $1\frac{1}{4}$" bars.

The marks give the distinguishing number which signifies the grade of the metal, also the letter of the bar and number of specimens taken from that bar.

No. 5070.

ANNULAR SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 273.

Marks, 1 C_1.

Diameters, { exterior, 1".
interior, ".900.

Sectional area, .149 square inch.

Gauged length, 1".

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
745	5,000	.0001	.....	
1,490	10,000	.0004	.....	
2,235	15,000	.0006	.....	
2,980	20,000	.0007	.....	
3,725	25,000	.0009	.....	
4,470	30,000	.0011	0.	
5,215	35,000	.0012	.....	
5,960	40,000	.0014	0.	
6,705	45,000	.0016	.0001	
6,854	46,000	.0017	.....	
7,003	47,000	.0017	.....	Elastic limit; load fell.
6,407	43,000	.0086	.....	
6,556	44,000	.0099	.....	
6,705	45,000	.0224	.....	
7,450	50,000	.03	.....	
8,195	55,000	.05	.....	
8,940	60,000	.09	.....	
9,685	65,000	.20	.....	
9,776	65,610	.30	.....	Tensile strength.

Elongation of inch section, ".47.

Exterior diameter at fracture, ".76.

Appearance of fracture, silky.

No. 5071.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 273.

Marks, 1 C_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	
745	5,000	.0001	.....	
1,490	10,000	.0003	.....	
2,235	15,000	.0006	.....	
2,980	20,000	.0008	.....	
3,725	25,000	.0010	.....	
4,470	30,000	.0011	0.	
5,215	35,000	.0014	0.	
5,960	40,000	.0015	.0001	
6,556	44,000	.0018	.....	Elastic limit.
6,705	45,000	.0045	.....	Load fell.
6,556	44,000	.0089	.....	
6,705	45,000	.0175	.....	
6,854	46,000	.0185	.....	
7,003	47,000	.0209	.....	
7,152	48,000	.0227	.....	
7,301	49,000	.0248	.....	
7,450	50,000	.0279	.0259	
8,195	55,000	.04	.....	
8,940	60,000	.07	.....	
9,685	65,000	.14	.....	
9,826	65,950	.22	.....	Tensile strength.

Elongation of inch section, ″.43.
Exterior diameter at fracture, ″.77.
Appearance of fracture, silky.

No. 5072.

SPECIMEN FROM OUTER END OF ENDURANCE SHAFT NO. 243.

Marks, 1 B_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
745	5,000	.0001	.....	
1,490	10,000	.0004	.....	
2,235	15,000	.0006	.....	
2,980	20,000	.0009	.....	
3,725	25,000	.0010	.....	
4,470	30,000	.0012	0.	
5,215	35,000	.0014	.....	
5,960	40,000	.0015	.....	Elastic limit.
		.0222	.....	
6,109	41,000	.0238	.....	
6,258	42,000	.0264	.....	
6,407	43,000	.0291	.....	
6,556	44,000	.0304	.....	
6,854	46,000	.04	.....	
7,450	50,000	.05	.....	
7,748	52,000	.06	.....	
8,046	54,000	.08	.....	
8,394	56,000	.10	.....	
8,642	58,000	.13	.....	
8,940	60,000	.18	.....	
8,978	60,250	.23	.....	Tensile strength.

Elongation of inch section, ″.45.
Exterior diameter at fracture, ″.76.
Appearance of fracture, silky.

No. 5073.

SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 243.

Marks, $1\,B_1$.

Diameters, { exterior, 1″. interior, ″.900.

Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In ganged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
745	5,000	.0001	.....	
1,490	10,000	.0003	.....	
2,235	15,000	.0004	.....	
2,980	20,000	.0006	.....	
3,725	25,000	.0008	.....	
4,470	30,000	.0010	0.	
5,215	35,000	.0013	.....	
5,960	40,000	.0015	0.	
6,109	41,000	.0016	.....	Elastic limit.
6,258	42,000	.0018	.....	
6,407	43,000	.0047	.....	
6,556	44,000	.0055	.....	
6,705	45,000	.0074	.....	
6,854	46,000	.0078	.....	
7,003	47,000	.0100	.....	
7,152	48,000	.0117	.....	
7,301	49,000	.0125	.....	
7,450	50,000	.0142	.0120	
7,748	52,000	.0179	.....	
8,046	54,000	.0225	.....	
8,642	58,000	.03	.....	
8,940	60,000	.04	.....	
9,238	62,000	.05	.....	
9,387	63,000	.....	.....	Tensile strength.

Elongation of inch section, ″.12.
Exterior diameter at fracture, ″.93.
Appearance of fracture, silky, with small discolored sections.

Fractured outside the 1″ gauged length. Upwards of fifty short minute lines of fractures were opened during the progress of the test. These lines were circumferential in their direction, and from ″.02 to ″.06 long, being mere visible lines in width.

The metal at the sides of these cracks was discolored, indicating that the formation of the cracks occurred prior to this tensile test, and they were doubtless formed during the rotating test.

No. 5074.

SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 230.

Marks, 1 A_6.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
745	5,000	.0002	.....	
1,490	10,000	.0004	.....	
2,235	15,000	.0006	.....	
2,980	20,000	.0008	.....	
3,725	25,000	.0009	.....	
4,470	30,000	.0012	.0001	
5,215	35,000	.0014	.....	
5,960	40,000	.0016	.0001	
6,109	41,000	.0017	.....	
6,258	42,000	.0018	.....	Elastic limit.
5,811	39,000	.0029	.....	
5,960	40,000	.0220	.....	
6,556	44,000	.03	.....	
7,152	48,000	.04	.....	
7,450	50,000	.05	.....	
7,748	52,000	.07	.....	
8,046	54,000	.09	.....	
8,344	56,000	.10	.....	
8,642	58,000	.14	.....	
8,940	60,000	.27	.....	Tensile strength.

Elongation of inch section, ″.46.
Exterior diameter at fracture, ″.76.
Appearance of fracture, silky.

No. 5075.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 230.

Marks, 1 A_6.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
745	5,000	.0001	.....	
1,490	10,000	.0003	.....	
2,235	15,000	.0005	.....	
2,980	20,000	.0007	.....	
3,725	25,000	.0009	.....	
4,470	30,000	.0011	0.	
5,215	35,000	.0014	.....	
5,960	40,000	.0018	.0002	
6,407	43,000	.0022	.....	Elastic limit.
6,556	44,000	.0026	.....	
6,705	45,000	.0030	.0013	
6,854	46,000	.0036	.....	
7,003	47,000	.0041	.....	
7,152	48,000	.0048	.....	
7,301	49,000	.0060	.....	
7,450	50,000	.0064	.....	
7,748	52,000	.0090	.....	
8,046	54,000	.0113	.....	
8,940	60,000	.02	.....	
9,536	64,000	.03	.....	
10,122	67,930	.11	.....	Tensile strength.

Elongation of inch section, ″.33.
Exterior diameter at fracture, ″.80.
Appearance of fracture, silky.

No. 5076.

ANNULAR SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 258.

Marks, 1 B_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
745	5,000	.0001	.....	
1,490	10,000	.0003	.....	
2,235	15,000	.0005	.....	
2,980	20,000	.0007	.....	
3,725	25,000	.0009	.....	
4,470	30,000	.0011	0.	
5,215	35,000	.0013	.....	
5,960	40,000	.0015	0.	
6,109	41,000	.0016	.....	Elastic limit; load fell.
5,960	40,000	.0197	.....	
6,109	41,000	.0230	.....	
6,258	42,000	.0249	.....	
6,407	43,000	.0265	.....	
6,556	44,000	.0282	.....	
7,152	48,000	.03	.....	
7,450	50,000	.04	.....	
7,748	52,000	.05	.....	
8,046	54,000	.07	.....	
8,344	56,000	.08	.....	
8,642	58,000	.10	.....	
8,940	60,000	.13	.....	
9,238	62,000	.20	.....	Tensile strength.

Elongation of inch section, ″.45.
Exterior diameter at fracture, ″.76.
Appearance of fracture, silky.

No. 5077.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 258.

Marks, 1 B_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
745	5,000	.0002	.....	
1,490	10,000	.0003	.....	
2,235	15,000	.0005	.....	
2,980	20,000	.0007	.....	
3,725	25,000	.0008	.....	
4,470	30,000	.0010	0.	
5,215	35,000	.0013	.....	
5,960	40,000	.0015	.0002	Elastic limit.
6,109	41,000	.0018	.....	
6,258	42,000	.0019	.....	
6,407	43,000	.0021	.....	
6,556	44,000	.0023	.....	
6,705	45,000	.0025	.0008	
6,854	46,000	.0028	.....	
7,003	47,000	.0030	.....	
7,152	48,000	.0034	.....	
7,301	49,000	.0039	.....	
7,450	50,000	.0042	.0023	
7,599	51,000	.0047	.....	
7,748	52,000	.0049	.....	
7,897	53,000	.0054	.....	
8,046	54,000	.0065	.....	
8,195	55,000	.0069	.0049	
8,344	56,000	.0076	.....	
8,493	57,000	.0084	.....	
8,642	58,000	.0093	.....	
8,791	59,000	.0106	.....	
8,940	60,000	.0113	.0088	
9,834	66,000	.02	.....	
10,728	72,000	.03	.....	
11,175	75,000	.08	.....	
11,376	76,350	.14	.....	Tensile strength.

Elongation of inch section, ″.30.
Exterior diameter at fracture, ″.81.
Appearance of fracture, silky.

No. 5078.

ANNULAR SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 265.

Marks, 1 B_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
745	5,000	.0002	.....	
1,490	10,000	.0003	.....	
2,235	15,000	.0005	.....	
2,980	20,000	.0007	.....	
3,725	25,000	.0009	.....	
4,470	30,000	.0011	.0001	
5,215	35,000	.0013	.....	
5,960	40,000	.0015	.0001	
6,407	43,000	.0016	.....	
6,556	44,000	.0017	.....	Elastic limit; load fell.
5,960	40,000	.0116	.....	
6,109	41,000	.0189	.....	
6,258	42,000	.0203	.....	
6,407	43,000	.0219	.....	
6,556	44,000	.0237	.....	
6,705	45,000	.0269	.....	
6,854	46,000	.0284	.....	
7,450	50,000	.03	.....	
7,748	52,000	.04	.....	
8,046	54,000	.05	.....	
8,344	56,000	.07	.....	
8,642	58,000	.08	.....	
8,940	60,000	.09	.....	
9,238	62,000	.11	.....	
9,536	64,000	.15	.....	
9,748	65,420	.22	.....	Tensile strength.

Elongation of inch section, ″.46.
Exterior diameter at fracture, ″.76.
Appearance of fracture, silky.

No. 5079.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 265.

Marks 1 B_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
745	5,000	.0001	.....	
1,490	10,000	.0003	.....	
2,235	15,000	.0005	.....	
2,980	20,000	.0007	.....	
3,725	25,000	.0009	.....	
4,470	30,000	.0010	0.	
5,215	35,000	.0012	.....	
5,960	40,000	.0014	0.	
6,109	41,000	.0015	.....	
6,258	42,000	.0016	.....	
6,407	43,000	.0017	.....	
6,556	44,000	.0018	.....	
6,705	45,000	.0019	.0002	
6,854	46,000	.0020	.....	Elastic limit.
7,003	47,000	.0026	.....	
7,152	48,000	.0042	.....	
7,301	49,000	.0100	.....	
7,450	50,000	.0134	.0114	
7,599	51,000	.0162	.....	Three surface cracks developed.
7,748	52,000	.0184	.....	
8,642	58,000	.03	.....	
8,704	58,420	.....	.....	Tensile strength.

Elongation of inch section, ″.08.
Exterior diameter at fracture, ″.94.
Appearance of fracture, silky.
Failed in detail, tearing apart from two initial cracks, on opposite sides of the specimen. One of these cracks was about ″.10 long, measured circumferentially on the specimen, and extended through the full thickness of the specimen, ″.05. Over thirty surface cracks were visible after the test.

No. 5082.

ANNULAR SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 206.

Marks, 1 A_1.
Diameters { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
745	5,000	.0002	.....	
1,490	10,000	.0004	.....	
2,235	15,000	.0006	.....	
2,980	20,000	.0008	.....	
3,725	25,000	.0010	.....	
4,470	30,000	.0012	0.	
5,215	35,000	.0014	.....	
5,960	40,000	.0015	.....	
6,109	41,000	.0016	.....	Elastic limit.
6,258	42,000	.0024	.....	
		.0141	.....	
6,407	43,000	.0250	.....	
6,556	44,000	.0266	.....	
7,450	50,000	.04	.....	
8,046	54,000	.06	.....	
8,642	58,000	.09	.....	
8,940	60,000	.11	.....	
9,238	62,000	.17	.....	
9,338	62,670	.26	.....	Tensile strength.

Elongation of inch section, ″.45.
Exterior diameter at fracture, ″.77.
Appearance of fracture, silky.

No. 5083.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 206.

Marks, 1 A_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
745	5,000	.0001	.....	
1,490	10,000	.0003	.....	
2,235	15,000	.0005	.....	
2,980	20,000	.0007	.....	
3,725	25,000	.0009	.....	
4,470	30,000	.0011	0.	
5,215	35,000	.0012	.....	
5,960	40,000	.0014	0.	
6,258	42,000	.0015	.....	
6,705	45,000	.0017	.0001	
7,152	48,000	.0019	.....	
7,450	50,000	.0022	.0004	
7,748	52,000	.0024	.....	
7,897	53,000	.0026	.....	
8,046	54,000	.0027	.....	
8,195	55,000	.0029	.0009	
8,344	56,000	.0030	.....	
8,493	57,000	.0032	.....	
8,642	58,000	.0033	.....	
8,791	59,000	.0034	.....	
8,940	60,000	.0036	.0014	
9,089	61,000	.0038	.....	
9,238	62,000	.0039	.....	
9,387	63,000	.0041	.....	
9,536	64,000	.0042	.....	
9,685	65,000	.0044	.0022	
9,834	66,000	.0047	.....	
9,983	67,000	.0049	.....	
10,132	68,000	.0053	.....	
10,281	69,000	.0058	.....	
10,430	70,000	.0061	.0035	
10,579	71,000	.0068	.....	
10,728	72,000	.0075	.....	
10,877	73,000	.0088	.....	
11,026	74,000	.0096	.....	
11,175	75,000	.0114	.0085	
12,514	83,990	.....	.....	Tensile strength.

Elongation of inch section, ″.07.
Exterior diameter at fracture, ″.94.
Appearance of fracture, silky.
Failed in detail, tearing apart from a small initial crack in the section under the bearing of the rotating test. Hundreds of minute surface cracks were developed.

No. 5080.

ANNULAR SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 209.

Marks, 1 A_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauge length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
745	5,000	.0001	.....	
1,490	10,000	.0003	.....	
2,235	15,000	.0005	.....	
2,980	20,000	.0006	.....	
3,725	25,000	.0008	.....	
4,470	30,000	.0009	0.	
5,215	35,000	.0011	.....	
5,960	40,000	.0013	0.	
6,109	41,000	.0014	.....	Elastic limit.
6,258	42,000	.0060	.....	
		.0198	.....	
6,407	43,000	.0238	.....	
6,556	44,000	.0243	.....	
6,854	46,000	.0296	.....	
7,450	50,000	.04	.....	
7,748	52,000	.06	.....	
8,046	54,000	.07	.....	
8,344	56,000	.08	.....	
8,642	58,000	.10	.....	
8,940	60,000	.14	.....	
9,238	62,000	.23	.....	Tensile strength.

Elongation of inch section, ″.46.
Exterior diameter at fracture, ″.76.
Appearance of fracture, silky.

No. 5081.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 209.

Marks, 1 A_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
745	5,000	.0002	.....	
1,490	10,000	.0003	.....	
2,235	15,000	.0005	.....	
2,980	20,000	.0006	.....	
3,725	25,000	.0008	.....	
4,470	30,000	.0010	0.	
5,215	35,000	.0012	.....	
5,960	40,000	.0014	.....	
6,705	45,000	.0015	.....	
7,450	50,000	.0019	.0002	Elastic limit.
7,599	51,000	.0181	.....	
7,748	52,000	.0194	.....	
7,897	53,000	.0230	.....	
8,046	54,000	.0260	.....	
8,344	56,000	.03	.....	
8,642	58,000	.04	.....	
8,940	60,000	.05	.....	
9,238	62,000	.07	.....	
9,536	64,000	.10	.....	
9,685	65,000	.12	.....	
9,745	65,400	.21	.....	Tensile strength.

Elongation of inch section, ″.40.
Exterior diameter at fracture, ″.78.
Appearance of fracture, silky.

No. 5098.

ANNULAR SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 274.

Marks, 2 B_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	0.	
5,215	35,000	.0012	.....	
5,960	40,000	.0013	0.	
6,556	44,000	.0014	.....	Elastic limit.
6,705	45,000	.0189	.....	
6,854	46,000	.0191	.....	
7,003	47,000	.0208	.....	
7,152	48,000	.0220	.....	
7,301	49,000	.0243	.....	
7,450	50,000	.0262	.0240	
8,046	54,000	.03	.....	
8,642	58,000	.04	.....	
9,238	62,000	.07	.....	
9,834	66,000	.09	.....	
10,430	70,000	.13	.....	
10,718	71,980	.22	.....	Tensile strength.

Elongation of inch section, ″.44.
Diameters at fracture, { exterior, ″.76. interior, ″.71.
Appearance of fracture, silky.

No. 5099.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 274.

Marks, 2 B_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0004	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0011	0.	
5,215	35,000	.0016	.0003	
5,960	40,000	.0027	.....	
6,109	41,000	.0031	.....	
6,258	42,000	.0035	.....	
6,407	43,000	.0045	.....	
6,556	44,000	.0057	.....	
6,705	45,000	.0079	.0062	
6,854	46,000	.0084	.....	
7,003	47,000	.0096	.....	
7,152	48,000	.0109	.....	
7,301	49,000	.0128	.....	
7,450	50,000	.0140	.0121	
7,599	51,000	.0157	.....	
7,748	52,000	.0171	.....	
7,897	53,000	.0187	.....	
8,046	54,000	.0199	.....	
8,195	55,000	.0225	.0203	
8,344	56,000	.0246	.....	
8,940	60,000	.03	.....	
9,536	64,000	.04	.....	
10,132	68,000	.07	.....	
10,728	72,000	.12	.....	
11,018	73,950	.21	.....	Tensile strength.

Elongation of inch section, ″.41.
Diameters at fracture, { exterior, ″.78. interior, ″.72.
Appearance of fracture, silky. No surface cracks in sight.

No. 5094.

ANNULAR SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 242.

Marks, 2 B_1.
Diameters, { exterior, 1″. interior, ″.900
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0011	0.	
5,215	35,000	.0013	.....	
5,960	40,000	.0015	0.	
6,407	43,000	.0016	.....	Elastic limit.
6,556	44,000	.0144	.....	
6,705	45,000	.0179	.0160	
6,854	46,000	.0185	.....	
7,152	48,000	.0222	.....	
7,450	50,000	.0262	.0241	
8,046	54,000	.03	.....	
8,642	58,000	.04	.....	
9,238	62,000	.06	.....	
9,834	66,000	.09	.....	
10,616	71,250	.21	.....	Tensile strength.

Elongation of inch section, ″.42.
Diameters at fracture, { exterior, ″.77. interior, ″.72.
Appearance of fracture, silky.

No. 5095.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 242

Marks, 2 B_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0008	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0010	0.	
5,215	35,000	.0012	.....	
5,960	40,000	.0018	.0004	
6,109	41,000	.0025	.....	
6,258	42,000	.0028	.....	
6,407	43,000	.0031	.....	
6,556	44,000	.0033	.....	
6,705	45,000	.0039	.0022	
6,854	46,000	.0043	.....	
7,003	47,000	.0050	.....	
7,152	48,000	.0056	.....	
7,301	49,000	.0067	.....	
7,450	50,000	.0076	.0055	
7,748	52,000	.0099	.....	
8,046	54,000	.0122	.....	
8,344	56,000	.0151	.....	
8,642	58,000	.0187	.....	
8,940	60,000	.0219	.0195	
9,536	64,000	.03	.....	
10,132	68,000	.04	.....	Surface crack opened.
10,728	72,000	.09	.....	
10,958	73,540	.14	....	Tensile strength.

Elongation of inch section, ″.28.
Diameters at fracture, { exterior, ″.87. interior, ″.81.

Appearance of fracture, silky. Failed in detail, fracture beginning at an initial crack, which was ″.05 long, and penetrated the walls of the specimen ″.02. There were numerous surface cracks, some easily visible, and a large number of minute cracks.

No. 5090.

ANNULAR SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 227.

Marks, 2 A_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0005	.....	
4,470	30,000	.0009	0.	
5,960	40,000	.0012	.....	
6,258	42,000	.0013	.....	
6,556	44,000	.0014	.....	Elastic limit.
6,705	45,000	.0019	.0005	
6,854	46,000	.0155	.....	
7,003	47,000	.0174	.....	
7,152	48,000	.0184	.....	
7,301	49,000	.0199	.....	
7,450	50,000	.0207	.0189	
8,344	56,000	.03	.....	
8,940	60,000	.04	.....	
9,536	64,000	.05	.....	
10,132	68,000	.07	.....	
10,728	72,000	.10	.....	
11,310	75,910	.22	.....	Tensile strength.

Elongation of inch section, ″.42
Diameters at fracture, { exterior, ″.78. interior, ″.71.
Appearance of fracture, silky.

No. 5091.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 227

Marks, 2 A_5.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149.	1,000	0.	0.	Initial load.
1,490	10,000	.0004	.....	
2,980	20,000	.0008	.....	
4,470	30,000	.0012	.0001	
5,215	35,000	.0016	.....	
5,960	40,000	.0028	.0014	
6,109	41,000	.0032	.....	
6,258	42,000	.0036	.....	
6,407	43,000	.0041	.....	
6,556	44,000	.0047	.....	Surface crack opened.
6,705	45,000	.0054	.....	
7,003	47,000	.0074	.....	
7,152	48,000	.0091	.....	
7,450	50,000	.0110	.....	
8,940	60,000	.03	.....	
9,220	61,880	.....	.....	Tensile strength.

Elongation of inch section, ″.10.
Exterior diameter at fracture, ″.93.
Appearance of fracture, silky. Failed in detail by tearing apart from two initial cracks, one of which penetrated the full thickness of the specimen.

No. 5092.

ANNULAR SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 231.

Marks, 2 A_6.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	0.	
5,960	40,000	.0013	.....	
6,109	41,000	.0014	.....	Elastic limit.
		.0106	.....	
6,258	42,000	.0150	.....	
6,565	44,000	.0176	.....	
6,854	46,000	.0213	.....	
7,152	48,000	.0254	.....	
7,450	50,000	.0288	.0268	
8,046	54,000	.03	.....	
8,642	58,000	.04	.....	
8,940	60,000	.06	.....	
9,536	64,000	.09	.....	
10,415	69,900	.24	.....	Tensile strength.

Elongation of inch section, ″.41.
Diameters at fracture, { exterior, ″.78. interior, ″.72.
Appearance of fracture, silky.

No. 5093.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT NO. 231.

Marks, 2 A_6.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0004	.....	
2,980	20,000	.0008	.....	
4,470	30,000	.0012	0.	
5,215	35,000	.0014	.....	
5,960	40,000	.0026	.0012	
6,109	41,000	.0030	.....	
6,258	42,000	.0035	.....	
6,407	43,000	.0039	.....	
6,556	44,000	.0043	.....	
6,705	45,000	.0050	.0032	
6,854	46,000	.0059	.....	
7,003	47,000	.0066	.....	
7,152	48,000	.0071	.....	
7,301	49,000	.0083	.....	
7,450	50,000	.0093	.0073	Micrometer removed and specimen carefully examined for cracks. None visible, however.
8,046	54,000	.01	.....	
8,642	58,000	.02	.....	
9,238	62,000	.03	.....	
9,834	66,000	.04	.....	
10,430	70,000	.08	.....	
10,770	72,280	.19	.....	Tensile strength.

Elongation of inch section, ″.36.
Diameters at fracture, { exterior, ″.80. interior, ″.74.
Appearance of fracture, silky. No cracks on surface of stem were developed.

No. 5088.

ANNULAR SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 224.

Marks, 2 A_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,908	20,000	.0007	.....	
4,470	30,000	.0009	0.	
5,215	35,000	.0011	.....	
5,960	40,000	.0013	0.	
6,705	45,000	.0014	.....	Elastic limit.
6,854	46,000	.0019	.....	
7,003	47,000	.0199	.....	
7,152	48,000	.0220	.....	
7,301	49,000	.0228	.....	
7,450	50,000	.0243	.0222	
8,344	56,000	.03	.....	
8,940	60,000	.04	.....	
9,536	64,000	.06	.....	
10,132	68,000	.09	.....	
10,728	72,000	.12	.....	
11,122	74,640	.24	.....	Tensile strength.

Elongation of inch section, ″.42.
Diameters at fracture, { exterior, ″.78. interior, ″.72.
Appearance of fracture, silky.

No. 5089.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 224.

Marks, 2 A_4.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0011	0.	
5,215	35,000	.0013	.....	
5,960	40,000	.0017	.0004	
6,109	41,000	.0019	.....	
6,258	42,000	.0023	.....	
6,407	43,000	.0026	.....	
6,556	44,000	.0027	.....	
6,705	45,000	.0031	.....	
6,854	46,000	.0037	.....	
7,003	47,000	.0045	.....	
7,152	48,000	.0055	.....	
7,301	49,000	.0069	.....	
7,450	50,000	.0080	.0062	
7,748	52,000	.0109	.....	
8,046	54,000	.0146	.....	Surface cracks developed.
8,344	56,000	.0180	.....	
8,642	58,000	.0225	.....	
8,940	60,000	.0274	.0249	
9,501	63,760	.....	.....	Tensile strength.

Elongation of inch section, ″.10.
Exterior diameter at fracture, ″.93.
Appearance of fracture, silky. Fractured in detail, beginning at cracks which were developed in the metal during the rotating test. There were a large number of cracks present, some of which penetrated the full thickness of the specimen.

No. 5086.

ANNULAR SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 217.

Marks, 2 A_3.

Diameters, { exterior, 1″. interior, ″.900.

Sectional area, .149 square inch.

Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0008	0.	
5,215	35,000	.0011	.....	
5,960	40,000	.0013	0.	
6,109	41,000	.0014	.....	
6,258	42,000	.0014	.....	
6,407	43,000	.0015	.....	
		.0017	.....	Elastic limit.
		.0020	.....	After 15 seconds.
		.0044	.....	After 1 minute.
6,556	44,000	.0087	.....	After 3 minutes.
		.0130	.....	After 5 minutes.
		.0138	.....	After 7 minutes.
		.0142	.....	After 10 minutes.
6,705	45,000	.0152	.....	
6,854	46,000	.0171	.....	
7,003	47,000	.0188	.....	
7,152	48,000	.0196	.....	
7,301	49,000	.0225	.....	
7,450	50,000	.0238	.....	
7,748	52,000	.0270	.....	
8,642	58,000	.04	.....	
9,238	62,000	.05	.....	
9,834	66,000	.08	.....	
10,824	72,640	.22	.....	Tensile strength.

Elongation of inch section, ″.42.

Diameters at fracture, { exterior, ″.78. interior, ″.72.

Appearance of fracture, silky.

No. 5087.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 217.

Marks, 2 A_3.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0004	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0011	0.	
5,215	35,000	.0013	.....	
5,960	40,000	.0015	.0001	
6,258	42,000	.0018	.....	
6,705	45,000	.0021	.0005	
6,854	46,000	.0024	.....	
7,003	47,000	.0027	.....	
7,152	48,000	.0037	.....	
7,301	49,000	.0044	.....	
7,450	50,000	.0060	.0042	
7,748	52,000	.0095	.....	
8,046	54,000	.0136	.....	
8,344	56,000	.0168	.....	
8,940	60,000	.02	.....	
10,430	70,000	.06	.....	A small surface crack visible.
11,360	76,240	.20	.....	Tensile strength.

Elongation of inch section, ″.37.
Diameters at fracture, { exterior, ″.81. interior, ″.75.

Appearance of fracture, silky. Numerous surface cracks developed. The depth of these cracks was very shallow; they did not appear to penetrate the metal ″.01.

No. 5084.

ANNULAR SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 205.

Marks, 2 A_1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
745	5,000	.0001	.....	
1,490	10,000	.0003	.....	
2,235	15,000	.0005	.....	
2,980	20,000	.0007	.....	
3,725	25,000	.0009	.....	
4,470	30,000	.0010	0.	
5,215	35,000	.0012	.....	
5,960	40,000	.0014	0.	
6,109	41,000	.0014	.....	Elastic limit.
6,258	42,000	.0017	.....	
		.0087	.....	
6,407	43,000	.0168	.....	
6,556	44,000	.0181	.....	
6,705	45,000	.0201	.....	
6,854	46,000	.0210	.....	
7,152	48,000	.0252	.....	
7,450	50,000	.0304	.0283	
8,046	54,000	.04	.....	
8,642	58,000	.05	.....	
8,940	60,000	.06	.....	
9,238	62,000	.08	.....	
9,536	64,000	.09	.....	
9,834	66,000	.11	.....	
10,132	68,000	.15	.....	
10,290	69,060	.22	.....	Tensile strength.

Elongation of inch section, ″.42.
Exterior diameter at fracture, ″.78.
Appearance of fracture, silky.

No. 5085.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 205.

Marks, 2 A^1.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
745	5,000	.0001	.....	
1,490	10,000	.0003	.....	
2,235	15,000	.0005	.....	
2,980	20,000	.0007	.....	
3,725	25,000	.0008	.....	
4,470	30,000	.0010	0.	
5,215	35,000	.0012	.....	
5,960	40,000	.0014	0.	
6,705	45,000	.0017	0.	
7,450	50,000	.0019	.0002	
7,599	51,000	.0022	.....	
7,748	52,000	.0023	.....	
7,897	53,000	.0025	.....	
8,046	54,000	.0027	.....	
8,195	55,000	.0028	.0010	
8,344	56,000	.0031	.....	
8,493	57,000	.0032	.....	
8,642	58,000	.0033	.....	
8,791	59,000	.0036	.....	
8,940	60,000	.0038	.0017	
9,238	62,000	.0042	.....	
9,536	64,000	.0052	.....	
9,834	66,000	.0058	.....	
10,132	68,000	.0076	.....	
10,430	70,000	.0104	.0077	
10,728	72,000	.0130	.....	
11,026	74,000	.0168	.....	
11,324	76,000	.0216	.0187	
11,920	80,000	.08	.....	
12,218	82,000	.04	.....	
12,369	83,010	.09	.....	Tensile strength.

Elongation of inch section, ″.13.
Exterior diameter, ″.91.
Appearance of fracture, silky. Hundreds of minute surface cracks developed.

No. 5096.

ANNULAR SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 210.

Marks, 2 A_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0008	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0011	0.	
5,215	35,000	.0013	.....	
5,960	40,000	.0014	0.	
6,258	42,000	.0015	.....	Elastic limit.
6,407	43,000	.0170	.....	
6,556	44,000	.0187	.....	
6,705	45,000	.0203	.0185	
6,854	46,000	.0212	.....	
7,152	48,000	.0244	.....	
7,450	50,000	.0289	.....	
8,046	54,000	.04	.....	
8,642	58,000	.05	.....	
9,238	62,000	.07	.....	
9,834	66,000	.10	.....	
10,430	70,000	.21	.....	Tensile strength.

Elongation of inch section, ″.42.
Diameters at fracture, { exterior, ″.77. interior, ″.72.
Appearance of fracture, silky.

No. 5097.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT No. 210.

Marks, 2 A_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0002	.....	
2,980	20,000	.0006	.....	
4,470	30,000	.0009	0.	
5,215	35,000	.0012	.....	
5,960	40,000	.0016	.0003	
6,109	41,000	.0018	.....	
6,258	42,000	.0019	.....	
6,407	43,000	.0021	.....	
6,556	44,000	.0024	.....	
6,705	45,000	.0025	.0009	
6,854	46,000	.0028	.....	
7,003	47,000	.0031	.....	
7,152	48,000	.0034	.....	
7,301	49,000	.0037	.....	
7,450	50,000	.0043	.0026	
7,748	52,000	.0078	.....	
8,046	54,000	.0125	.....	
8,344	56,000	.0157	.....	
8,642	58,000	.0216	.....	
8,940	60,000	.0269	.0244	
9,536	64,000	.03	.....	
10,132	68,000	.06	.....	
10,728	72,000	.12	.....	
10,942	73,440	.20	.....	Tensile strength.

Elongation of inch section, ″.39.
Diameters at fracture, { exterior, ″.79. interior, ″.73.
Appearance of fracture, silky. Very minute surface cracks opened.

No. 5100.

ANNULAR SPECIMEN FROM OUTER END OF ENDURANCE SHAFT NO. 204.

Marks, 3 A_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0007	.....	
4,470	30,000	.0011	0.	
5,960	40,000	.0014	0.	
6,705	45,000	.0015	.....	
7,450	50,000	.0016	0.	
7,599	51,000	.0017	.....	
7,748	52,000	.0018	.....	Elastic limit.
		.0073	.....	
7,897	53,000	.0135	.....	
8,046	54,000	.0137	.....	
8,195	55,000	.0149	.0126	
8,344	56,000	.0154	.....	
8,493	57,000	.0165	.....	
8,642	58,000	.0174	.....	
8,791	59,000	.0194	.....	
8,940	60,000	.0208	.0184	
10,132	68,000	.03	.....	
11,324	76,000	.04	.....	
12,516	84,000	.09	.....	
13,112	88,000	.16	.....	
13,170	88,390	.21	.....	Tensile strength.

Elongation of inch section, ″.36.
Diameters at fracture, { exterior, ″.81. interior, ″.74.
Appearance of fracture, silky.

No. 5101.

ANNULAR SPECIMEN FROM MIDDLE OF ENDURANCE SHAFT NO. 204.

Marks 3 A_2.
Diameters, { exterior, 1″. interior, ″.900.
Sectional area, .149 square inch.
Gauged length, 1″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
149	1,000	0.	0.	Initial load.
1,490	10,000	.0003	.....	
2,980	20,000	.0005	.....	
4,470	30,000	.0010	0.	
5,960	40,000	.0014	0.	
6,705	45,000	.0017	.....	
7,450	50,000	.0019	.0001	
8,195	55,000	.0022	.0002	
8,940	60,000	.0025	.0004	
9,685	65,000	.0030	.0007	
9,834	66,000	.0031	.....	
9,983	67,000	.0032	.....	
10,132	68,000	.0033	.....	
10,281	69,000	.0034	.....	
10,430	70,000	.0035	.0010	
10,579	71,000	.0038	.....	
10,728	72,000	.0039	.....	
10,877	73,000	.0040	.....	
11,026	74,000	.0042	.....	
11,175	75,000	.0044	.....	
11,324	76,000	.0047	.....	
11,622	78,000	.0052	.....	
11,920	80,000	.0060	.0030	
12,218	82,000	.0080	.....	
12,516	84,000	.0087	.....	
12,814	86,000	.0099	.....	
13,112	88,000	.0119	.....	
13,410	90,000	.0139	.0103	
14,566	97,760	.....	.....	Tensile strength.

Elongation of inch section, ″.05.
Exterior diameter at fracture, ″.98.
Appearance of fracture, silky.

TABULATION OF ANNULAR TENSION SPECIMENS FROM BARS RUPTURED BY ENDURANCE TESTS OF ROTATING SHAFTS.

Tension test number.	Endurance test number.	Material.	Carbon.	Location in shaft.	Sectional area.	Elastic limit per square inch.	Tensile strength per square inch.	Gauged length.	Elongation of inch section	Contraction of area.	Appearance of fracture.
			Per cent.		*Sq. in.*	*Pounds.*	*Pounds.*	*Inch.*	*Per cent.*	*Per cent.*	
5070	273	Gautier steel	0.161	End	.149	47,000	65,610	1	47		Silky.
5071	273	do	0.161	Middle	.149	44,000	65,950	1	43		Do.
5072	243	do	0.161	End	.149	40,000	60,250	1	45		Do.
5073	243	do	0.161	Middle	.149	41,000	63,000	1	12		Silky, with small discolored sections. Surface cracks.
5074	230	do	0.161	End	.149	42,000	60,000	1	46		Silky.
5075	230	do	0.161	Middle	.149	43,000	67,930	1	33		Do.
5076	258	do	0.161	End	.149	41,000	62,009	1	45		Do.
5077	258	do	0.161	Middle	.149	40,000	76,350	1	30		Do.
5078	265	do	0.161	End	.149	44,000	65,420	1	46		Do.
5079	265	do	0.161	Middle	.149	46,000	58,420	1	08		Silky. Surface cracks developed.
5082	206	do	0.161	End	.149	41,000	62,670	1	45		Silky.
5083	206	do	0.161	Middle	.149		83,990	1	07		Silky. Surface cracks developed.
5080	209	do	0.161	End	.149	41,000	62,000	1	46		Silky.
5081	209	do	0.161	Middle	.149	50,000	65,400	1	40		Do.
5098	274	do	0.172	End	.149	44,000	71,930	1	44		Do.
5099	274	do	0.172	Middle	.149		73,950	1	41		Do.
5094	242	do	0.172	End	.149	43,000	71,250	1	42		Do.
5095	242	do	0.172	Middle	.149		73,540	1	28		Silky. Surface cracks developed.
5090	227	do	0.172	End	.149	44,000	75,910	1	42		Silky.
5091	227	do	0.172	Middle	.149		61,880	1	10		Silky. Surface cracks developed.
5092	231	do	0.172	End	.149	41,000	69,900	1	41		Silky.
5096	231	do	0.172	Middle	.149		72,280	1	36		Do.
5088	224	do	0.172	End	.149	45,000	74,640	1	42		Do.
5089	224	do	0.172	Middle	.149		63,760	1	10		Silky. Surface cracks developed.
5086	217	do	0.172	End	.149	44,000	72,640	1	42		Silky.
5087	217	do	0.172	Middle	.149		76,240	1	37		Silky. Surface cracks developed.
5084	205	do	0.172	End	.149	41,000	69,060	1	42		Silky.
5085	205	do	0.172	Middle	.149		83,010	1	13		Silky. Surface cracks developed.
5096	210	do	0.172	End	.149	42,000	70,000	1	42		Silky.
5097	210	do	0.172	Middle	.149		73,440	1	39		Silky. Surface cracks developed.
5100	204	do	0.341	End	.149	52,000	88,390	1	36		Silky.
5101	204	do	0.341	Middle	.149		97,760	1	05		Do.

COMPRESSION TESTS

OF

SPECIMENS FROM RUPTURED ENDURANCE SHAFTS.

COMPRESSION TESTS OF SPECIMENS FROM RUPTURED ENDURANCE SHAFTS.

No. 1160.

SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 209.

Marks, 1 A_2.
Length over all, 12″.
Diameter, ″.976.
Sectional area, .75 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
750	1,000	0.	0.	Initial load.
3,750	5,000	.0015	0.	
7,500	10,000	.0031	0.	
11,250	15,000	.0049	0.	
15,000	20,000	.0067	.....	
18,750	25,000	.0081	.....	
22,500	30,000	.0099	0.	
26,250	35,000	.0118	.....	
30,000	40,000	.0139	.0009	Elastic limit.
30,750	41,000	.0150	.....	
31,500	42,000	.0168	.....	Appreciable lateral deflection.
32,250	43,000	.0260	.....	
33,000	44,000	.0375	.....	
33,750	45,000	.0535	.0383	Ultimate strength.

Failed by triple flexure. Deflected obliquely upward.

No. 1161.

SPECIMEN FROM OUTER END OF ENDURANCE SHAFT No. 210.

Marks, 2 A_2.
Length over all, 12″.
Diameter, ″.988.
Sectional area, .76 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
760	1,000	0.	0.	Initial load.
3,800	5,000	.0016	0.	
7,600	10,000	.0031	.....	
11,400	15,000	.0050	.....	
15,200	20,000	.0067	.0001	
19,000	25,000	.0091	.....	
21,660	28,500	.....	.....	Elastic limit.
22,800	30,000	.0237	.0140	
30,400	40,150	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected obliquely downward.

No. 1162.

Specimen from Outer End of Endurance Shaft No. 211.

Marks, 3 A_1.
Length over all, 12″.
Diameter, ″.992.
Sectional area, .77 square inch.
Gauged length, 10″.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Compression.	Set.	
Pounds.	*Pounds.*	*Inch.*	*Inch.*	
770	1,000	0.	0.	Initial load.
3,850	5,000	.0017	0.	
7,700	10,000	.0033	.....	
11,550	15,000	.0049	.....	
15,400	20,000	.0067	.....	
19,250	25,000	.0088	.0007	Elastic limit.
20,020	26,000	.0130	.....	
20,790	27,000	.0175	.....	
21,560	28,000	.0193	.....	
22,330	29,000	.0218	.....	
23,100	30,000	.0248	.0148	
34,610	44,950	.....	.....	Ultimate strength.

Failed by triple flexure. Deflected obliquely downward.

CHEMICAL ANALYSES OF STEEL CASTINGS AND FORGINGS.

Chemical analyses of steel carriage castings.

Marks.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.	Copper.	Aluminum.
	Total.	Graphitic.	Combined.						
10 R 199 C L_1 M	0.363	0.011	0.352	0.684	0.427	0.005	0.061	0.000	0.707
12 C 158 C L_2 M	0.442	0.024	0.418	0.814	0.446	0.090	0.056	0.000	0.854
12 C 206 C T_1 M	0.385	0.013	0.372	0.903	0.535	0.000	0.062	0.000	0.846
12 C 202 C T_1 M	0.324	0.023	0.301	0.807	0.470	0.060	0.029	0.000	0.090
12 C 215 C T_2 M	0.493	0.026	0.467	0.751	0.472	0.060	0.029	0.000	0.096
12 C 220 C T_1 M	0.370	0 023	0.347	0.703	0.401	0.061	0.026	.....	0.092
12 C 219 C L_3 M	0.337	0.022	0.355	0.736	0.527	0.062	0.027	.....	0.081
12 C 221 C T_1 M	0.334	0.021	0.313	0.761	0.413	0.059	0.027	.....	0.073
12 C 222 C T_1 M	0.407	0.024	0.373	0.727	0.451	0.062	0.029	0.000	0.100
12 C 225 C L_1 M	0.420	0.024	0.396	0.732	0.527	0.060	0.022	0.000	0.089

Chemical analyses of steel forgings for gun construction.

Marks.	Carbon.			Manganese.	Silicon.	Sulphur.	Phosphorus.
	Total.	Graphitic.	Combined.				
5231 B_1 M T_1 O	0.595	0.005	0.590	0.676	0.197	0.030	0.021
5267 B_1 M T_2 I	0.454	0.007	0.447	0.738	0.205	0.033	0.023
4773 B_1 F_1 T_2 I	0.468	0.019	0.449	0.637	0.159	0.030	0.022
5138 B_1 M T_2 M	0.454	0.014	0.440	0.690	0.195	0.028	0.023
5121 B_1 B T_1 M	0.367	0.016	0.351	0.435	0.037	0.027	0.023

SHOT LINES.

RETESTS OF LINEN SHOT LINES; ALSO TESTS OF SAMPLES FROM TWO NEW COILS, AND TESTS OF COTTON FLOATING LINES FOR THE U. S. LIFE-SAVING SERVICE.

SHOT LINES.

SHOT LINE NO. 9.

Coil No. 4208. Report 1890.
Original tensile strength 1,274 pounds.

No. 6485.

Sample from outside end of coil.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
100	.....	2.45	.....	
200	.....	3.32	.....	
300	.....	3.95	.....	
400	.....	4.44	.....	
500	.....	4.70	3.12	
600	.....	5.07	.....	
700	.....	5.35	.....	
800	.....	5.52	.....	
900	.....	5.83	.....	
998	.....	.....	.....	Tensile strength.

Parted one strand at the pin.

No. 6491.

Additional sample taken from outside end of coil No. 4208.
Tensile strength, 1,184 pounds.
Parted one strand at the pin.

No. 6486.

Sample from inside end of coil No. 4208.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
100	.....	3.37	.....	
200	.....	4.20	.....	
300	.....	4.78	.....	
400	.....	5.11	.....	
500	.....	5.43	3.60	
600	.....	5.70	.....	
700	.....	5.88	.....	
800	.....	6.17	.....	
900	.....	6.31	.....	
920	.....	.....	.....	Tensile strength.

Parted two strands 2 feet from pin.

SHOT LINE NO. 9.

Coil No. 4213. Report 1890.
Original tensile strength, 1,205 pounds.

No. 6487.

Sample from outside end of coil.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
100	.....	3.60	.....	
200	.....	4.50	.....	
300	.....	5.10	.....	
400	.....	5.52	.....	
500	.....	5.91	4.14	
600	.....	6.22	.....	
700	.....	6.47	.....	
800	.....	6.66	.....	
900	.....	6.90	.....	
1,000	.....	7.06	.....	
1,100	.....	.....	.....	Tensile strength.

Parted two strands; one strand at pin and one strand 1½ feet from pin.

No. 6488.

Sample from inside end of coil No. 4213.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
100	.....	3.10	.....	
200	.....	4.00	.....	
300	.....	4.63	.....	
400	.....	5.03	.....	
500	.....	5.39	3.65	
600	.....	5.66	.....	
700	.....	5.88	.....	
800	.....	6.14	.....	
900	.....	6.35	.....	
1,000	.....	6.55	.....	
1,048	.....	.....	.....	Tensile strength.

Parted one strand 4 feet from pin.

SHOT LINE No. 9.

Coil No. 4218. Report 1890.
Original tensile strength, 1,195 pounds.

No. 6489.

Sample from outside end of coil.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
100	.....	4.32	.....	
200	.....	5.35	.....	
300	.....	6.10	.....	
400	.....	6.56	.....	
500	.....	6.93	4.93	
600	.....	7.28	.....	
700	.....	7.58	.....	
800	.....	7.78	.....	
900	.....	8.00	.....	
1,000	.....	8.24	.....	
1,052	.....	.....	.....	Tensile strength.

Parted two strands at the pin.

No. 6490.

Sample from inside end of coil No. 4218.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
100	.....	4.43	.....	
200	.....	5.48	.....	
300	.....	6.19	.....	
400	.....	6.70	.....	
500	.....	7.12	5.10	
600	.....	7.45	.....	
700	.....	7.77	.....	
800	.....	8.02	.....	
900	.....	8.30	.....	
1,000	.....	8.45	.....	
1,051	.....	.....	.....	Tensile strength.

Parted one strand 1½ feet from pin.

SHOT LINE NO. 7.

Coil No. 4021. Report 1890.
Original tensile strength, 830 pounds.

No. 6492.

Sample from outside end of coil.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
100	.....	2.50	.....	
200	.....	3.38	.....	
300	.....	3.85	.....	
400	.....	4.33	.....	
500	.....	4.68	2.62	
599	.....	.....	.....	Tensile strength.

Parted one strand 2½ feet from pin.

No. 6493.

Sample from inside end of coil No. 4021.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
100	.....	2.55	.....	
200	.....	3.34	.....	
300	.....	3.92	.....	
400	.....	4.32	.....	
500	.....	4.68	3.10	
600	.....	5.00	.....	
610	.....	.....	.....	Tensile strength.

Parted one strand 10 inches from pin.

SHOT LINE NO. 7.

Coil No. 4018. Report 1890.
Original tensile strength, 815 pounds.

No. 6494.

Sample from outside end of coil.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
100	.....	2.89	.....	
200	.....	3.66	.....	
300	.....	4.22	.....	
400	.....	4.60	.....	
500	.....	4.92	3.26	
600	.....	5.24	.....	
647	.....	.....	.....	Tensile strength.

Parted one strand at the pin.

No. 6495.

Sample from inside end of coil No. 4018.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
100	.....	3.70	.....	
200	.....	4.43	.....	
300	.....	4.97	.....	
400	.....	5.38	.....	
500	.....	5.70	3.96	
608	.....	5.98	.....	Tensile strength.

Parted one strand 2 feet from pin.

SHOT LINE No. 7.

Coil No. 3918. Report 1890.
Original tensile strength, 755 pounds.

No. 6496.

Sample from outside end of coil.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
100	.....	3.12	.....	
200	.....	4.03	.....	
300	.....	4.52	.....	
400	.....	4.92	.....	
500	.....	5.26	3.48	
600	.....	5.54	.....	
624	.....	.....	.....	Tensile strength.

Parted one strand 4 inches from pin.

No. 6497.

Sample from inside end of coil No. 3918.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
100	.....	4.14	.....	
200	.....	4.83	.....	
300	.....	5.33	.....	
400	.....	5.74	.....	
500	.....	6.05	4.40	
590	.....	.....	.....	Tensile strength.

Parted one strand 2 feet 3 inches from pin.

No. 6498.

Additional sample from outside end of coil No. 3918.
Thoroughly wetted in water at 70° F. before testing.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
100	.....	10.00	.....	
200	.....	11.06	6.80	
300	.....	11.46	.....	
400	.....	11.95	.....	
500	.....	12.27	{ 10.60 { 10.10	After ½ minute.
600	.....	12.71	.....	
700	.....	13.90	.....	
722	.....	.....	.....	Tensile strength.

Parted two strands near middle of length.

SHOT LINE No. 4.

Coil No. 4079. Report 1890.
Original tensile strength, 336 pounds.

No. 6499.

Sample from outside end of coil.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
50	.....	3.63	.....	
100	.....	4.80	.....	
150	.....	5.54	.....	
200	.....	6.10	4.00	
250	.....	6.49	.....	Tensile strength.

Parted one strand 2 feet 6 inches from pin.

No. 6500.

Sample from inside end of coil No. 4079.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
50	.....	4.50	.....	
100	.....	5.67	.....	
150	.....	6.40	.....	
200	.....	6.96	5.10	
250	.....	7.43	.....	
287	.....	.....	.....	Tensile strength.

Parted two strands 6 inches from pin.

SHOT LINE No. 4.

Coil No. 4105. Report 1890.
Original tensile strength, 353 pounds.

No. 6501.

Sample from outside end of coil.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
50	.....	3.35	.....	
100	.....	4.59	.....	
150	.....	5.22	.....	
200	.....	5.76	3.72	
250	.....	6.11	.....	
284	.....	.....	.....	Tensile strength.

Parted three strands 3 inches from pin.

No. 6502.

Sample from inside end of coil No. 4105.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
50	.....	2.75	.....	
100	.....	3.53	.....	
150	.....	4.12	.....	
200	.....	4.50	2.65	
250	.....	4.79	.....	
300	.....	5.08	.....	
318	.....	.....	.....	Tensile strength.

Parted one strand 12 inches from pin.

SHOT LINE No. 4.

Coil No. 4055. Report 1890.
Original tensile strength, 318 pounds.

No. 6503.

Sample from outside end of coil.
Gauged length, 6 feet.

Applied loads.		In ganged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
50	.....	3.12	.....	
100	.....	4.33	.....	
150	.....	5.10	.....	
200	.....	5.67	3.56	
250	.....	6.10	.....	
273	.....	.....	.....	Tensile strength.

Parted three strands 3 feet from pin.

No. 6505.

Additional sample from outside end of coil No. 4055.
Thoroughly wetted in water at 70° F. before testing.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
50	.....	9.81	.....	
100	.....	10.13	.....	
200	.....	11.89	9.90 9.35	After ½ minute.
250	.....	12.30	.....	
300	.....	12.62	.....	
350	.....	13.06	.....	
384	.....	.....	.....	Tensile strength.

Parted three strands at middle of length.

No. 6504.

Sample from inside end of coil No. 4055.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
50	.....	4.30	.....	
100	.....	5.40	.....	
150	.....	6.08	.....	
200	.....	6.60	4.51	
250	.....	.....	.....	Tensile strength.

Parted one strand 2 feet 6 inches from pin.

Additional samples from coils previously tested and reported in Annual Report 1890.

No. of test.	No. of line.	Length tested.	Original test.		Present test.			Fractured.
			No. of coil.	Tensile strength.	Tensile strength.	Time.		
		Feet.		*Pounds.*	*Pounds.*	*Mins.*	*Secs.*	
7017	9	4	4208	1274	1174	.....	.....	1 strand at pin.
7018	9	4	4213	1205	1266	.....	.....	1 strand at middle.
7019	9	4	4218	1195	1220	.....	.....	1 strand at pin.
7020	9	6	4208	.....	1290	2	10	2 strands at pin.
7021	9	6	4213	.....	1210	2	8	1 strand at pin.
7022	9	6	4218	.....	1255	1	52	1 strand 18″ from pin.
7023	9	6	4208	.....	1220	0	45	3 strands 14″ from pin.
7024	9	6	4213	.....	1290	0	17	2 strands at pin.
7025	9	6	4218	.....	1250	0	48	3 strands at pin.

Sample No. 7024 was first strained with 900 pounds tension, then load released, and again loaded until ruptured. The time, seventeen seconds, was that occupied during the final period of the test.

No. of test.	No. of line.	Length tested.	Original test.		Present test.			Fractured.
			No. of coil.	Tensile strength.	Tensile strength.	Time.		
		Feet.		*Pounds.*	*Pounds.*	*Mins.*	*Secs.*	
7026	9	4	4208	.....	912	1	51	3 strands 2″ from pin.
7027	9	4	4213	.....	838	2	5	1 strand at pin.
7028	9	4	4218	.....	826	1	58	1 strand at pin.

Samples Nos. 7026, 7027, and 7028 were exposed one hour, lying loosely on a steam pipe about 50 feet distant from the boiler, which carried 45 pounds of steam.

A stem graduated thermometer laid on the steam pipe and covered with a layer of cotton waste 1½″ thick gradually acquired a temperature of 225° F. at the end of twenty minutes' exposure. Uncovering the bulb of the thermometer, but still keeping it in contact with the steam pipe, the temperature fell to 205° F. at the expiration of five minutes.

It is believed that, due to the circulation of cool air, few of the fibers of the shot lines acquired a temperature above the higher indication of the thermometer, and did not reach the temperature due the boiler pressure.

No. of test.	No. of line.	Length tested.	Original test.		Present test.			Fractured.
			No. of coil.	Tensile strength.	Tensile strength.	Time.		
		Feet.		*Pounds.*	*Pounds.*	*Mins.*	*Secs.*	
7029	9	4	4208	.....	1232	1	45	1 strand at pin.
7030	9	4	4213	.....	1139	2	15	3 strands at pin.
7031	9	4	4218	.....	1240	1	35	1 strand 10″ from pin.
7046	9	4	4213	.....	1342	2	4	1 strand at pin.

Samples Nos. 7029, 7030, and 7031 were exposed one hour, lying on a steam pipe, the same as described in samples Nos. 7026 to 7028, inclusive.

After exposure to this heat the samples were returned to the storehouse where all of the shot lines had been kept during the preceding five months, seventeen hours later returned to the testing room, and then tested with the results here shown.

It would appear from the results that a brief period of heating had not caused permanent loss in strength.

Sample No. 7046 was steamed before testing; a stream of live steam was discharged into a bucket in which the sample remained five minutes. It was immediately tested after removal from the bucket.

No. of test.	No. of line.	Length tested.	Original test.		Present test.			Fractured.
			No. of coil.	Tensile strength.	Tensile strength.	Time.		
		Feet.		*Pounds.*	*Pounds.*	*Mins.*	*Secs.*	
7032	7	4	3918	755	658	1	52	1 strand 9″ from pin.
7033	7	4	4018	815	706	1	12	1 strand 14″ from pin.
7034	7	4	4021	830	760	1	10	2 strands 10″ from pin.
7035	7	6	3918	.....	702	1	20	1 strand at middle.
7036	7	6	4018	.....	705	1	17	2 strands at pin.
7037	7	6	4021	.....	702	1	26	1 strand 28″ from pin.
7038	4	4	4055	318	348	1	10	2 strands 8″ from pin.
7039	4	4	4079	336	302	1	10	2 strands 15″ from pin.
7040	4	4	4105	353	352	0	57	1 strand at middle.

It is not apparent from the foregoing tests of shot lines that any substantial difference in strength is displayed, due to testing samples 4 feet or 6 feet long between pins.

A remarkable loss in strength occurs in the specimens which were tested immediately after drying on a steam pipe, but this loss in strength was shown to be temporary; a recovery in strength ensued when a few hours time intervened between the drying and the testing, the samples in the meantime having an opportunity to acquire a limited amount of moisture.

Previous to making these tests several days of rainy weather took place.

The steamed sample was immediately placed in the testing machine, and was still warm when the test began, but cooled rapidly as the water escaped during the test.

The test was made as quickly as possible to show that heat in the presence of moisture did not cause a loss in strength.

Linen Shot Lines.

New lines. Coils Nos. 1 and 2. Size No. 7.

Weight of coils, { No. 1, 20 pounds. / No. 2, 21 pounds.

Diameter of lines, ″.19.

Composed of three strands of eight threads each.

Lay, one turn in $\frac{3}{4}$″.

No. 6890.

Coil No. 1.

Sample from outside end.

Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	1.10	.....	
100	.....	1.74	.....	
150	.....	2.33	.....	
200	.....	2.64	.....	
250	.....	3.10	.....	
300	.....	3.49	.....	
350	.....	3.85	.....	
400	.....	4.06	.....	
450	.....	4.33	.....	
500	.....	4.68	.....	
550	.....	.....	.....	Tensile strength.

Parted two threads 30″ from pin.

No. 6891.

Coil No. 1.
Sample from inside end.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	2.11	.....	
100	.....	2.95	.....	
150	.....	3.75	.....	
200	.....	4.23	.....	
250	.....	4.73	.....	
300	.....	5.11	.....	
350	.....	5.42	.....	
400	.....	5.71	.....	
450	.....	6.08	.....	
458	.....	.....	.....	Tensile strength.

Parted one strand 19″ from pin.

No. 6892.

Coil No. 1.
Additional sample from outside end.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	1.48	.....	
100	.....	2.20	.....	
150	.....	2.80	.....	
200	.....	3.34	.....	
250	.....	3.84	.....	
300	.....	4.20	.....	
350	.....	4.52	.....	
400	.....	4.81	.....	
450	.....	5.08	.....	
500	.....	5.33	.....	
542	.....	.....	.....	Tensile strength.

Parted three strands 36″ from pin.

ADDITIONAL SAMPLES TAKEN FROM OUTSIDE END OF COIL NO. 1 SIX WEEKS LATER.

No. 7041.

Length tested, 4 feet.
Time making test, one minute seven seconds.
Tensile strength, 574 pounds.
Parted one strand at the middle.

No. 7043.

Length tested, 6 feet.
Time making test, one minute forty-two seconds.
Tensile strength, 620 pounds.
Parted one strand 24″ from pin.

No. 6893.

Coil No. 2.
Sample from outside end.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	2.48	.....	
100	.....	3.35	.....	
150	.....	4.23	.....	
200	.....	4.89	.....	
250	.....	5.52	.....	
300	.....	6.03	.....	
350	.....	6.48	.....	
400	.....	6.92	.....	
432	.....	.....	.....	Tensile strength.

Parted three strands at pin.

No. 6894.

Coil No. 2.
Sample from inside end.
Gauged length, 6 feet.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
50	.....	2.50	.....	
100	.....	3.85	.....	
150	.....	5.03	.....	
200	.....	5.96	.....	
250	.....	6.69	.....	
300	.....	7.25	.....	
350	.....	7.73	.....	
400	.....	8.27	.....	
411	.....	.....	.....	Tensile strength.

Parted three strands 24″ from pin.

No. 6895.

Coil No. 2.
Additional sample from inside end.
Tested wet.
Contraction due to wetting, 6″.70 in 6 feet.
Actual gauged length when tested, 5 feet 5″.3.

Applied loads.		In gauged length.		Remarks.
Total.	Per square inch.	Elongation.	Set.	
Pounds.	*Pounds.*	*Inches.*	*Inches.*	
0	.....	0.	0.	
50	.....	7.82	.....	
100	.....	9.70	.....	
150	.....	10.90	.....	
200	.....	11.73	.....	Load released and new stroke of piston of testing machine taken.
250	.....	12.42	.....	
300	.....	12.90	.....	
350	.....	13.42	.....	
400	.....	13.81	.....	
450	.....	14.24	.....	
500	.....	14.80	.....	
526	.....	.....	.....	Tensile strength.

Parted three strands 30″ from pin.

ADDITIONAL SAMPLES TAKEN FROM OUTSIDE END OF COIL NO. 2 SIX WEEKS LATER.

No. 7042.

Length tested, 4 feet.
Time making test, one minute twenty seconds.
Tensile strength, 552 pounds.
Parted two strands at the middle.

No. 7044.

Length tested, 6 feet.
Time making test, one minute fifty-three seconds.
Tensile strength, 508 pounds.
Parted two strands 24″ from pin.

No. 7045.

Length tested 6 feet.
Time making test, one minute twenty seconds.
Tensile strength, 492 pounds.
Parted two strands 22″ from pin.

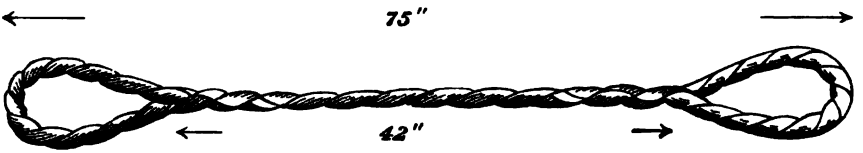
MAYNARD'S FLOATING ROPES.

BRAIDED COTTON ROPES WITH CORK CORE. ENDS SECURED TO PINS IN THE TESTING MACHINE.

No. of test.	Diameters.		Strands.	Threads per strand.	Length tested.	Time.		Tensile strength.	Parted.
	Outside.	Cork core.							
	Inch.	*Inch.*			*Feet.*	*Mins.*	*Secs.*	*Pounds.*	
7049	.32	.21	12	4	4	3	35	313	At the pin.
7050	.46	.30	12	6	4	3	10	706	Do.
7051	.58	.34	12	9	4	2	50	852	Do.
7052	.80	.50	12	12	4	3	55	1,455	Do.

TENSILE TEST OF MANILA ROPE USED IN ARSENAL FOUNDRY JIB CRANE.

Sample prepared with eye-splices for securing to the testing machine.



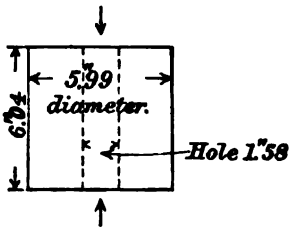
Diameter of rope, 1″.6.
Circumference of rope, $4\frac{3}{4}$″.
Three strands of 55 threads each.
Total number of threads, 165.
Lay, one turn in $4\frac{1}{4}$″.
Splices wet before testing.
Tensile strength, 19,850 pounds=120 pounds per thread.
Parted one strand at the splice.

No. of test.	Diameter.	Circumference.	Strands.	Threads per strand.	Lay, one turn in.	Length tested.	Time.		Tensile strength.	Parted.
	Inches.	*Inches.*			*Inches.*	*Feet.*	*Mins.*	*Secs.*	*Pounds.*	
7047	$\frac{9}{16}$	$1\frac{5}{8}$	3	7	$1\frac{1}{2}$	4	3	12	2,560	1 strand 7″ from pin.
7048	$\frac{11}{16}$	$2\frac{1}{8}$	3	17	$2\frac{1}{8}$	4	5	30	5,720	1 strand at pin.

COMPRESSION OF RUBBER BUFFERS.

No. 6506.

BUFFER BRANDED: "NEWTON RUBBER CO. FACTORY, NEWTON UPPER FALLS, MASS."



Weight, 10 pounds 4⅞ ounces. Temperature, 70° F.

Applied loads.	Height.	Compression.	Set.	Remarks.
Pounds.	*Inches.*	*Inches.*	*Inch.*	
5,000	4.77	1.27	.01	
10,000	3.79	2.25	.03	
20,000	2.76	3.28	.09	
5,000	4.46	1.58	.....	
10,000	3.33	2.71	.....	
20,000	2.67	3.37	.11	
5,000	4.40	1.64	.....	
10,000	3.21	2.83	.....	
20,000	2.63	3.41	.13	
Buffer removed from testing machine and exposed to zero temperature while packed in snow and salt for a period of 1½ hours. The test then resumed.				
0	5.92	.....	.12	
5,000	4.42	1.61	.....	Seam opened in cylindrical surface.
10,000	3.23	2.81	.....	
20,000	2.61	3.43	.15	
Again removed from the testing machine and packed in snow and salt, where it remained a period of 16 hours. Minimum temperature, 15° F.				
0	5.92	.....	.12	
5,000	4.43	1.61	.....	
10,000	3.21	2.83	.....	
20,000	2.64	3.40	.16	

RUBBER BUFFERS 6″ × 6″ BRANDED "NEWTON RUBBER CO. FACTORY, NEWTON UPPER FALLS, MASS."

No. of test.	5,000 pounds load.		10,000 pounds load.		20,000 pounds load.	
	Compression.	Set.	Compression.	Set.	Compression.	Set.
	Inches.	*Inch.*	*Inches.*	*Inch.*	*Inches.*	*Inch.*
6507	1.29	.01	2.21	.03	3.18	.09
6508	1.31	.02	2.26	.05	3.23	.08
6509	1.29	.03	2.25	.05	3.27	.10
6510	1.33	.02	2.34	.04	3.31	.11
6511	1.32	.02	2.29	.04	3.29	.08
6512	1.34	.02	2.32	.05	3.30	.08
6513	1.33	.02	2.27	.05	3.28	.10

COTTON CLOTH.

TENSILE TESTS OF COTTON CLOTH FOR TARGETS.

Samples 2″ wide each; 12″ long between jaws of testing machine.
Picks per inch, { warp, 42. filling, 42.

No. of test.	Sample tested.	Tensile strength.
		Pounds.
6,209	Warp	96
6,210	Filling	106

TESTS MADE FOR PRIVATE PARTIES DURING THE FISCAL YEAR ENDED JUNE 30, 1894.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1893				
July...	Copper wire	Chas. R. Fletcher	Boston	Mass.
	Steel tubing	Pope Manufacturing Co	do	Mass.
	Chain	Thomson Electric Welding Co	do	Mass.
	Steel tubing and plate.	Pope Manufacturing Co	do	Mass.
	Wrought-iron bars	Rhode Island Locomotive Works	Providence	R. I.
	Sandstone	James & Marra	Springfield	Mass.
	Concrete cubes	Robert L. Harris	Wilkesbarre	Pa.
	Sandstone	New England Brownstone Co	Cromwell	Conn.
Aug...	Dynamometer	W. & S. Hydraulic Machine Works	New York	N. Y.
	Sandstone	Chas. M. Cassell	Norfolk	Va.
	Steel tubing	Pope Manufacturing Co	Boston	Mass.
	Manhole covers and catch-basin frame.	City of Boston	do	Mass.
	Steel rails	West End Street Railway Co	do	Mass.
	Bricks	S. Edwin Tobey	do	Mass.
	Cement and concrete.	Robert L. Harris	Wilkesbarre	Pa.
	Aluminum bronze.	Waldo & Stout	Bridgeport	Conn.
	Cotton ropes	Arthur A. Brigham	Boston	Mass.
	Steel rails	The Johnson Company	Johnstown	Pa.
	Copper tubing	F. W. Dean	Boston	Mass.
Sept...	Cast iron	do	do	Mass.
	Cast iron and brass	Ludlow Valve Manufacturing Co	Troy	N. Y.
	Steel rails	The Johnson Company	Johnstown	Pa.
	Marble	Loring & Phipps	Boston	Mass.
	Leather belt	Leland Tanning Co	do	Mass.
	Cast iron	City of Boston	do	Mass.
	do	Armington & Sims Engine Co	Providence	R. I.
	Brass and bronze	Deoxidized Bronze and Metal Co	Bridgeport	Conn.
	Riveted joint	The Safety Car Heating and Lighting Co.	New York	N. Y.
	Steel rails	The Johnson Company	Johnstown	Pa.
	Steel tubing	Pope Manufacturing Co	Hartford	Conn.
	Cast iron	F. W. Dean	Boston	Mass.
	Steel wire rope	C. U. Cotting	do	Mass.
	do	Whittier Machine Co	do	Mass.
Oct....	Steel rails	Thomson Electric Welding Co	Lynn	Mass.
	Hydraulic gauge	American Steam Gauge Co	Boston	Mass.
	Boiler tubes	The Coles Flue Expander and Beader Co.	Hartford	Conn.
	Cast iron	Golding Co	Boston	Mass.
	Steel plate	Geo. H. Lloyd	do	Mass.
	Granite	John M. Elfolk	Freeport	Me.
	Wrought-iron bar.	Rhode Island Locomotive Works	Providence	R. I.
	Tubing	H. W. Smith	Somerville	Mass.
Nov...	Steel rails	Thomson Electric Welding Co	Lynn	Mass.
	Belting	Main Belting Co	Boston	Mass.
	Riveted joints	Schenectady Locomotive Works	Schenectady	N. Y.
	Manhole covers	City of Boston	Boston	Mass.
	Steel plate	D. H. Andrews	do	Mass.
	Steel bars	Howe, Brown & Co., Limited	do	Mass.
	Steel wire rope	C. U. Cotting	do	Mass.
	Bush hammer	Hawkridge Bros	do	Mass.
	Bricks	F. L. White & Co	do	Mass.
	Steel rails	The Johnson Company	Johnstown	Pa.
Dec....	Wrought iron	Morrison, Colwell & Page	Troy	N. Y.
	Steel bars	Pennsylvania Railroad Co	Altoona	Pa.
	Steel plate	D. H. Andrews	Boston	Mass.
	Granite	The McDonald Stone and Machine Co	Cambridge	Mass.
	Freight car bolsters.	Freight Car Equipment Co	St. Louis	Mo.
	Wrought-iron plate.	Hartford Steam Boiler Inspection and Insurance Co.	Boston	Mass.
	Copper cylinder	Leonard Smokeless Powder Co	New York	N. Y.
	Cast iron	City of Boston	Boston	Mass.
	Granite	Diamond Blue Granite Co	Augusta	Ga.
1894.				
Jan....	Cotton drillings	Pepperrell Manufacturing Co	Boston	Mass.
	Manhole covers	Mechanics Iron Foundry	do	Mass.
	Chain	Lebanon Chain Works	Lebanon	Pa.
	Steel wire rope	Elcock & Sons	West Quincy	Mass.
	Linen shot lines	M. F. Whiton & Co	Boston	Mass.

TESTS MADE FOR PRIVATE PARTIES DURING THE FISCAL YEAR ENDED JUNE 30, 1894—Continued.

Date.	Material.	For whom tested.		
		Name.	City.	State.
1894.				
Jan.....	Wrought-iron plate.	Hartford Steam Boiler Inspection and Insurance Co.	Boston.....	Mass.
Feb....	Sandstone	Shaler & Hall Quarry Co.....	Portland.....	Conn.
	Granite.....	P. Copeland & Co.....	Richmond	Va.
	Bricks	Alumina Shale Brick Co.....	Bradford.....	Pa.
	Paving bricks.....	Jamestown Shale Paving Brick Co..	Jamestown	N. Y.
	Bricks	Portland Stone Co.....	Chicago.....	Ill.
	Steel plate.....	Hartford Steam Boiler Inspection and Insurance Co.	Hartford	Conn.
	.....do	Stone, Carpenter & Wilson	Providence	R. I.
	Steel plate and stay bolts.	Fitchburg Railroad Co.....	Boston.....	Mass.
	Steam gauges	Star Brass Manufacturing Co.....	.....do	Mass.
	Plate iron.....	Houghton & Richards.....	.....do	Mass.
	Brick	Gethmann Bros. Brick Co.....	Gladbrook.....	Iowa.
	.....do	Dakota Land and Colonization Co...	New York.....	N. Y.
Mar ...	Safety shackle....	James B. Miller.....	Rockland.....	Me.
	Chain.....	Bradlee & Co.....	Philadelphia.....	Pa.
	Steel wire rope....	J. A. Roebling's Sons Co.....	Trenton	N. J.
	Rubber belting...	Revere Rubber Co.....	Boston.....	Mass.
	Wrought iron.....	Bradlee & Co.....	Philadelphia.....	Pa.
	Chain.....	Lebanon Chain Works.....	Lebanon	Pa.
	Bricks.....	Boston Building Material Co.....	Boston.....	Mass.
	Steel bars.....	American Projectile Co.....	Lynn	Mass.
	.....do	Simonds Rolling Machinery Co.....	Fitchburg	Mass.
Apr ...	Woodnoid	Hygienic Refrigerator Co.....	Boston.....	Mass.
	Cotton belting....	Revere Rubber Co.....	.....do	Mass.
	Bronze joint.....	Waldo Foundry Co.....	New York.....	N. Y.
	Steel casting.....	Bath Iron Works, Limited.....	Bath.....	Me.
	Steel wire.....	Washburn & Moen Manufacturing Co.	Worcester.....	Mass.
	Chain, and chain iron.	Bradlee & Co.....	Philadelphia.....	Pa.
May ...	Paving brick.....	Savage Fire Brick Co.....	Keystone Junction	Pa.
	Steel plates..... ..	Edward Kendall & Sons.....	Cambridgeport ...	Mass.
	Linen shot lines .	M. F. Whiton & Co.....	Boston.....	Mass.
	Steel bars.....	Simonds Rolling Machine Co.....	Fitchburg	Mass.
	Tie rods...	West End Street Railway Co.....	Boston.....	Mass.
	Steel bars.....	Leon Dion.....	.....do	Mass.
	Chain, and chain iron.	Bradlee & Co.....	Philadelphia.....	Pa.
	Shelf support.....	Sneed & Co. Iron Works	Louisville	Ky.
June...	Rubber belting...	Revere Rubber Co.....	Boston.....	Mass.
	Steel angles.....	A. H. Howland.....	.....do	Mass.
	Chain.....	Berlin Iron Bridge Co.....	East Berlin.....	Conn.
	Bricks.....	Bay State Brick Co.....	Boston.....	Mass.
	Paving bricks....	Somers & Johnsonburg Manufacturing Co.	.....do	Mass.
	.....do	Board of Public Works.....	Jamestown	N. Y.
	Chain.....	J. B. Carr & Co.....	Troy.....	N. Y.
	Sandstone	C. F. Parker.....	Wallawalla	Wash.
	Steel plates.....	Metropolitan Sewerage Commission.	Boston.....	Mass.
	Steel plate.....	P. H. Dudley.....	New York.....	N. Y.
	Steel rail.....	.....do	.....do	N. Y.
	Steel bar.....	Bethlehem Iron Co.....	South Bethlehem..	Pa.

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